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1. CONSEQUENCE ASSESSMENT

1.1 Introduction

Consequence assessment is the process used to evaluate the impacts of a release of radioactive or other hazardous materials. Consequence assessment capabilities necessary to meet the time-urgent needs of emergency response are addressed in this chapter. The guidance focuses on the process of performing timely initial assessments necessary to support critical first decisions and the continuous process of refining those initial assessments as more information and resources become available.

The term "consequence" as used in this guidance means "the result or effect of the release of hazardous materials into the environment." Specifically, the "consequences" of concern are human health effects. The assessment of consequences is the evaluation and interpretation of all available information concerning an actual or potential release of hazardous materials to the environment for the purpose of estimating personnel exposure/dose. These estimates are then compared to human health and/or Protective Action Criteria (PAC) and used as the basis for emergency management decision-making (e.g., event classification, protective actions, notification, public information, etc.)

The primary objective of the consequence assessment process is to provide timely, useful information to Emergency Managers for use in making informed decisions to protect people (e.g., workers, the public, and responders). For purposes of this guidance, "timely" means fast enough so that decisions can be made and implemented in time to avoid or reduce consequences to people. "Useful" means the right information in the correct units communicated clearly and effectively. "Information" includes answers to the questions "Who will be affected?", "What will be the nature and magnitude of the impact?", "When will the impact begin and end?", and "Where (geographically) will the impact be felt?". In addition to Emergency Managers, other important audiences for consequence assessment information include responders, workers, the public, the media, regulators (state, local, and federal), and tribal or other government officials.

Consequence assessment capability should be consistent with the type and magnitude of actual and potential facility hazards assessed and should primarily apply to the Emergency Planning Zone (EPZ). However, the capability should provide for limited extension beyond the EPZ, including support to offsite organizations for field/environmental monitoring.

This chapter will provide a description of how the consequence assessment process works during the course of an emergency (sections 1.2, Elements of a Consequence Assessment) and then will guide the user through the process of developing the tools necessary to conduct consequence assessment during an event (sections 1.3, Consequence Assessment Process, 1.4 Timely Initial Assessment, 1.5 Continuous Assessment). The tools are developed as part of the planning aspect of the Emergency Management System. Finally, the chapter will provide guidance on how the information from consequence assessment is used to support decision making during an emergency (Section 1.6, Integration, Coordination, and Quality Assurance).

The guidance will provide suggestions and recommendations for developing the following: 1) a timely initial consequence assessment tool comprised of predetermined source terms (taken from Volume II) receptors and calculations based on appropriate assumed meteorological conditions; 2) continuous assessment tools, based on level of hazard, 3) procedures for using the timely initial assessment tool and the continuous assessment tools; 4) specially formatted and worded results of the consequence assessment to be used by the Public Information Officer; and 5) documentation of quality control measures used to ensure that the consequence assessment tools can confidently be used to make decisions for protecting the workers and the public.

Base Program. There are no minimum requirements specified for the Base Program site/facility in Consequence Assessment. Consequence Assessment capabilities for the Base Program will be derived from other DOE orders, Federal laws/regulations, or local ordinances. The guidance presented in this chapter could be useful in developing such a capability.

1.2 Elements of Consequence Assessment

Consequence assessment is conducted in three phases during emergency response.

During the first phase, performed immediately upon recognition of the emergency, tabulated results of consequence calculations are used to make an initial rough estimate of the consequences.

The second phase, Timely Initial Assessment (TIA), is performed in the first few minutes of response and involves the use of any available real-time event and meteorological information and simplified models to estimate event-specific consequences.

The third phase, Continuous Assessment, begins with activation of the consequence assessment capability of the Emergency Response Organization (ERO) and continues throughout the response.

Once the emergency response is terminated and recovery begins there may be a need for a facility and/or environmental assessment. Assessment activities during recovery operations are beyond the scope of this guidance. However, some of the references provided in this guidance do address these activities.

1.2.1 Event Detection, Recognition, Categorization, and Classification

Initial activity associated with a facility's emergency response includes detection, recognition, categorization, and classification of an emergency event.

Events and event symptoms are recognized through direct observation and/or the monitoring of indicators. These indicators are compared to Emergency Action Levels (EALs) to determine the level of severity, resulting in event classification and appropriate level of response. EALs are based on consequence estimates and evaluations performed using information from the Hazards Assessment. These calculations, based on postulated events and pre-selected default input parameters, indicate potential consequences of an emergency event. This represents the first phase in the assessment of consequences.

The process and methodology for performing a facility Hazards Assessment are discussed in Volume II. Guidance on developing criteria for event categorization and classification is discussed in Volume III, Chapter 3.

1.2.2 Timely Initial Assessment

In the first minutes of response (within 30 minutes), actions are taken to improve the quantitative understanding of impacts. This is the TIA phase of assessment.

The goal is a rapid assessment that yields a conservative estimate of the upper bound of the potential consequences. TIA actions are designed to require minimal time and effort and the results may have a high degree of uncertainty. However, the decisions influenced by the TIA are some of the most crucial made during the entire response. TIA is conducted at a time when only limited information and data are available; as a result, reliance is placed on pre-calculated results found in the Hazards Assessment and simplified calculational methods. Methods typically include simple computerized calculations and pre-calculated values, plume overlays, nomograms, and graphs. Tools for performing TIA are developed from the Hazards Surveys and Assessments, Safety Analysis Reports (SARs), Probabilistic Risk Assessment (PRA) Reports, and/or regulatory compliance activities. These calculational tools can be organized into a single reference (see Appendix A for an example). TIA actions are often completed by first response personnel prior to the arrival of the ERO consequence assessment staff.

Steps in the TIA process are depicted in Figure 1.1. The TIA process is replaced with a continuous assessment process once the consequence assessment ERO staff arrive.

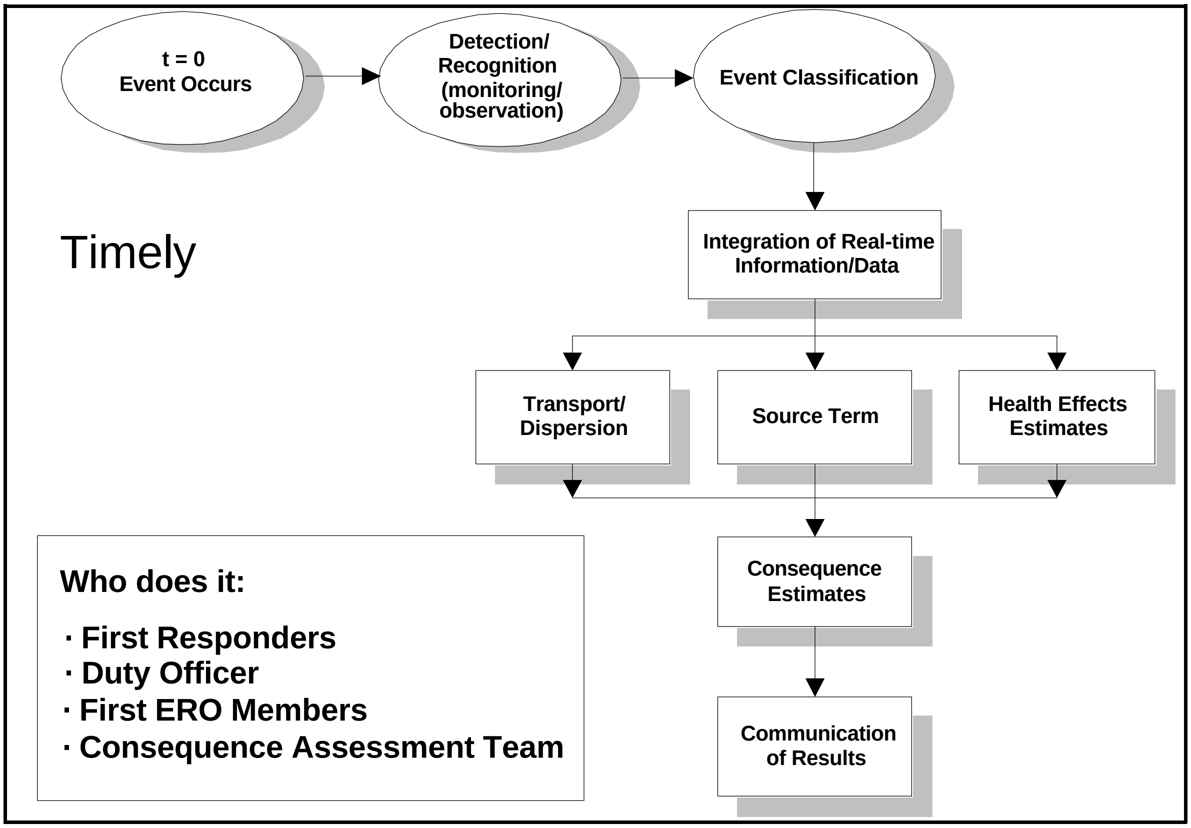

Figure 1. The process of timely initial assessment.

1.2.3 Continuous Assessment

As the ERO, facilities, and resources are activated, additional information is gathered and emergency conditions become better understood. This is the "continuous" phase of the assessment process. The same general steps are employed (see Figure 1.2) as in TIA, but the process is cyclical, with increasing levels of sophistication in the analysis tools, input accuracy (e.g., source term and meteorology), technical expertise, and eventually feedback from field monitoring efforts. This part of the process is conducted with the resources and professional judgment of the consequence assessment staff of the ERO.

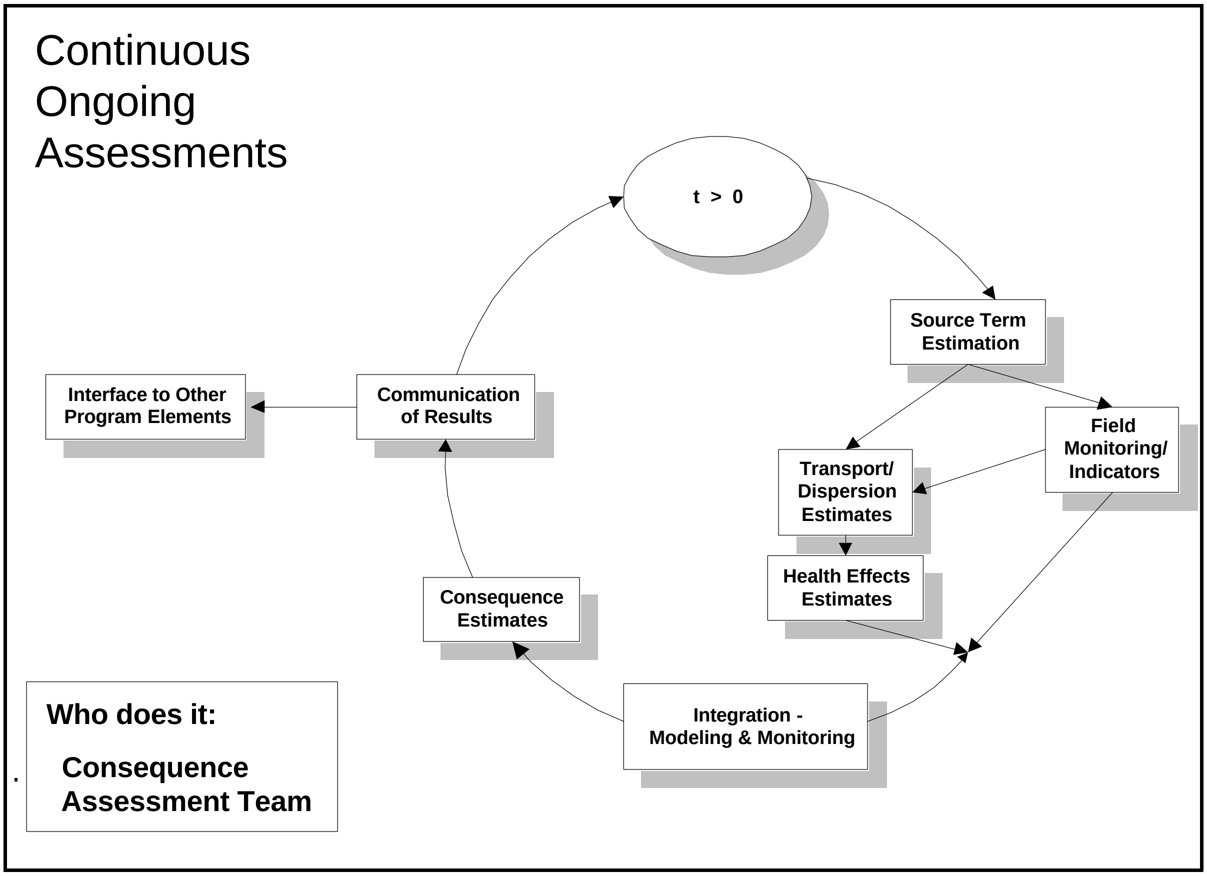

Figure 2. The process of continuous assessment.

1.3 Consequence Assessment Process

The process of consequence assessment for both TIA and continuous assessments consists of three elements: (1) the identification of input data/information, (2) the calculation of consequences, and (3) the interpretation and communication of the results.

1.3.1 Identification of Input Data/Information

"Inputs" are the information that "feed" the consequence assessment process. Information needs fall into three categories: source term, meteorology, and receptor locations. Source term information indicates how much hazardous material has been released into the environment. Meteorological information is used to determine how the material will be transported through the atmosphere to the receptors, and how rapidly the receptors will be affected. Receptor information identifies the specific locations and distances at which consequence estimates are needed.

Source Term. A “source term” represents the amount of material released to the environment or the rate at which it is released. The information needed to characterize the source term includes the following.

- Total quantity of material present.
- Quantity of material released from primary barrier.
- Quantity of material released to environs.
- Properties of the material.
- Duration of release.
- Rate of release.
- Height of release.
- Vertical velocity/buoyancy of release.

Not all of the information listed above may be necessary to adequately define the release source term. The information necessary will depend on the material of interest and the model or calculational technique used. Some of this information may be determined by real-time measurements and used directly in models (e.g., volume in tank, stack monitor reading). Others may be known only theoretically (such as gas density) or may have to be assumed, based on limited empirical evidence, in order to arrive at a release estimate that can be used in consequence calculations (e.g., particle size distribution). A generic formula for determining a source term is discussed in Volume II, Section 3.5.

The following are some recommendations for emergency planners on preparation for determining source terms during emergency response.

- Gather and present information on source terms for a range of events/conditions. This information should have been developed as a part of the Hazards Survey or Assessment process. The key information should be extracted from the Hazards Survey or Assessment (and other references) and placed into a format that can be used as a quick reference by response personnel (see Appendix A for an example).

- Correlate the predetermined source terms with observed conditions (i.e., personnel observations, instrument readings, monitoring results, etc.). Users of the documentation should be able to rapidly compare available information to the predetermined source terms to select the one that is most appropriate for the event at hand or to apply the best modifying factors. In the absence of any other information, the user may simply identify the affected building and use the most conservative source term listed.

- Identify technical experts within the local organization who have experience with the hazardous materials and their associated physical and chemical phenomena. Ensure they are a part of the ERO consequence assessment team or arrange for them to be available for consultation.

Meteorology. Information about meteorological conditions is necessary to predict how and where hazardous materials released to the atmosphere will be transported and deposited. The types of meteorological data used in consequence assessments include default, real-time, and regional forecasts. Default information (usually worst case) is used in generating the precalculated consequence estimates that are part of the tools used to support TIA. Real-time information is gathered in the vicinity of the release to characterize the region of transport.

For complex meteorological conditions, additional real-time data from the region of transport may be necessary to adequately characterize transport and dispersion. Real-time data should be used to replace default values as soon as practical. Regional forecast information is used in parallel with real-time meteorology to semiquantitatively determine temporal changes in parameters that could affect consequence assessment calculations.

The most important real-time meteorological parameters for emergency response are related to the wind. The mean wind direction and speed provide the basis for determining *where* and *when* consequences will occur. The wind speed (dilution) coupled with atmospheric turbulence intensity (dispersion) provides the basis for determining *how much* hazardous material will arrive at the receptor. Other factors that have an effect on the transport, dispersion, and deposition of material include inversion layer height, precipitation, gravitational settling, temperature, and humidity.

The minimum data necessary to drive intermediate or advanced atmospheric dispersion models are wind speed, wind direction, and an indicator of atmospheric stability. The following describes how each meteorological parameter operates on a source term.

- Wind Direction.
    - Identifies plume trajectory and the downwind receptors.
    - Has little or no effect on concentration of effluents (except when terrain effects are included in the modeling).
    - Wind is *from* the direction reported.

- Wind Speed.
    - Establishes plume arrival time at a particular receptor.

- Dilutes source material (i.e., inversely proportional).
- Determines transport times to establish radioactive decay and plume depletion.

- Indicator of Atmospheric Stability.

  - Determines plume concentration at a particular receptor.
  - Disperses source material (Gaussian approximation often used).

Methods to acquire and use meteorological and other environmental data in consequence assessments should be commensurate with quantities of hazardous materials present in the facility and the need to accurately characterize the transport and dispersion of materials during a release. The environmental monitoring program required for consequence assessment should be based on an extension of the general environmental protection program required by DOE O 231.1 for each facility.

If the facility Hazards Assessment indicates that no potential emergencies and releases of material will be classified higher than Alert, no real-time meteorological monitoring capability is necessary beyond that required by other applicable DOE Orders. Access to representative meteorological information from non-facility resources, such as a local airport or the National Weather Service, will suffice.

If the facility Hazards Assessment indicates that no potential emergencies and releases of material will be classified higher than Site Area Emergency, use the following criteria for the geographic area within the site boundary.

- Sufficient continuous real-time meteorological information should be available to characterize atmospheric dispersion within the confines of the site. This capability should include a means to determine wind speed, wind direction, and atmospheric stability via instrumentation or trained observation.

- Generally, the measuring station providing meteorological input should be located within approximately 2 km of the potential release point(s). The number and location of meteorological monitoring stations necessary to characterize transport and dispersion conditions depend on the number and location of potential release points and the size and meteorological complexity in the region of transport.

- Calculational models used for consequence assessment should be appropriate for dispersion conditions specific to the facility and vicinity. Facility-specific characteristics addressed should include height of release point (i.e., elevated, ground-level, or mixed-mode), effluent temperature and velocity, building wake effects, and stack aerodynamic effects (i.e., plume rise). Local meteorological factors to be considered include lake breeze, urban heat island, mountain/valley winds, and other terrain effect.

If the facility Hazards Assessment indicates a potential General Emergency classification based on a postulated emergency release scenario, the following additional criteria apply in the region of transport.

- Sufficient continuous real-time meteorological data sources should be available to accurately characterize atmospheric dispersion for *offsite* areas potentially affected by a maximum release. The number of monitoring stations, and the sophistication of monitoring equipment necessary, will depend on terrain complexity and dispersion conditions.

- The increased distance and area involved in accurate characterization of atmospheric dispersion to the limits of potentially impacted offsite locations will likely require more sophisticated dispersion models. Models available should be able to provide estimates for any location of interest within and slightly beyond the limits of the EPZ.

The number of monitoring stations necessary to provide adequate real-time data is influenced by the complexity of the local terrain. Simple terrain is generally flat or relatively flat with no complex airflow patterns. Complex terrain airflow patterns are induced by either mountain-valley (complex-land) terrain features or by land-water (complex-water) interfaces.

Temporal variability of meteorological parameters occurs concurrently with terrain influences and is addressed by regional forecast information regardless of terrain complexity. Comprehensive treatment of transport considerations associated with Complex-Land and Complex-Water locations is *only* needed if the Hazards Assessment indicates significant impacts in the region of transport.

Receptors. As used in this guidance, a receptor is defined as "a point or location at which consequence estimates are performed for the purpose of determining event severity by estimating impacts on safety or human health." For facilities with hazardous materials programs, human health effects are the primary concern. The calculation of consequences at specific receptors helps answer the following.

- Who will be affected.
- Who will be notified.
- Who will have to respond.

- Where and when consequences will occur.
- Where consequences will be above classification or protective action thresholds.

Estimating consequences at specific receptors provides information that is used in event classification, protective action decisions, notification, reentry planning, termination of emergency response, and recovery planning/activities. Onsite receptors of interest include site facilities, facility and site boundaries, collocated workers, assembly areas, evacuation routes, and emergency response facilities. Offsite receptors of interest include population centers, special populations (e.g., hospitals, schools, nursing homes, day care centers, prisons), evacuation routes, relocation centers, environmental monitoring stations, and ingestion related locations (e.g., water supply intakes, farms, dairies, food processing plants).

It is recommended that all receptors of interest be identified and documented for each facility requiring a Hazards Assessment. This listing should be made part of the documentation provided to the ERO consequence assessment staff.

Information for each receptor should identify the wind direction that would affect the receptor, the name of the receptor, distance from facility, and plume travel time for a wind speed of 1 m/s. (It should be noted that this wind direction-receptor relationship is only valid for straight-line airflows over essentially flat terrain.) (See Appendix A for example.)

1.3.2 Calculation of Consequences

Calculational methods and resources should provide for projecting the quantitative impact of an actual or potential release of hazardous materials within the EPZ. Most standard methods/models for calculating consequences focus on airborne release assessments; however, other credible dispersion pathways may need to be addressed depending on the hazardous materials present and results of facility Hazards Assessment. The airborne release pathway typically represents the most time-urgent situation, requiring a rapid, coordinated response. Releases to aquatic and ground pathways may not have the same time-urgency, and calculational models for these pathways should be developed on a case-by-case basis if applicable to the individual facility.

The level of sophistication of calculational methods and models should be commensurate with facility-specific source terms, atmospheric transport and dispersion considerations, and potential severity of the consequences of a release. The following general guidelines should be applied.

- If the facility Hazards Assessment indicates that potential emergencies and releases of material will not be classified more severely than Alert, then consequence assessments should make use of simple calculational methods for post-event analysis. Sophisticated calculational methodology/models for consequence projections are usually not needed. Plans and procedures should identify protective actions to be implemented for the protection of personnel within the facility boundary or near the event scene.

- If the facility Hazards Assessment indicates that no accident scenario analyzed will result in an event classification higher than Site Area Emergency, then protective actions may be required beyond the facility boundary and throughout the site only.

The calculational methods and models should yield a quantitative prediction of the impact in a time that is short with respect to the time needed to carry out personnel protective actions. The calculation would typically involve the modeling of the release on a personal computer or use of well-designed manual calculations (e.g., nomograms, overlays, graphs, tables, etc.) Actual source term and environmental data input to a computer model may be provided by on-line systems or manual entry. The method/model used should be customized, as necessary, to address each major type of release scenario. For example, for an event resulting in an instantaneous release, such as an explosion, when the time period for calculations must be short, consequence assessment may be based on nomograms only. In contrast, consequence assessment may be based on complex computer calculations for a slower-paced event sequence. Advanced capabilities, such as the ability to perform rapid recalculations to consider changing conditions or information (including back-calculating a source term from field monitoring data), or analyze a range of hypothetical situations, may be desirable.

- If the facility Hazards Assessment indicates a potential for an emergency classification of General Emergency, then a release may require personnel protective actions beyond the site boundary and the consequence assessment methods should be capable of producing estimates to or beyond the limits of the EPZ. In addition to those capabilities discussed above under Site Area Emergency, the projection methods/models provided should yield a quantitative prediction of the offsite impact sufficient to allow timely (approximately 15 minutes) offsite protective action recommendations. Advanced features, such as on-line data entry, may be necessary to meet the time requirements for notification.

Three tiers of calculational methods have been identified to address consequence requirements.

1. **Elementary.** Pre-calculated consequences, such as tabulated hazards assessment or SAR results or ready reference graphs/figures. The accuracy is limited; they

usually provide plume centerline results at a single receptor; and they are easy and quick to use.

2. **Intermediate.** Simplified consequence calculations such as hand calculations, nomograms, overlays, and simplified PC-based computer models. Accuracy is limited; and they provide a simple plume footprint, centerline and off centerline estimates, results at several receptors, and are relatively easy and quick to use.

3. **Advanced.** Advanced computerized methods capable of more realistically modeling atmospheric transport and dispersion when operated by a subject matter expert. These are recommended for continuing assessments at high hazard facilities/sites with complex meteorological flows in the region of transport. They more accurately depict plume trajectories and provide complex plume footprints. Although they are generally slow and more difficult to use, recent advances in computer technology are reducing the run times.

Consequences are calculated for the purpose of comparing the results with criteria that relate to human health effects. The relevant criteria for radioactive materials are the Environmental Protection Agency (EPA) Protective Action Guides (PAGs), which are expressed in units of radiation dose (total effective dose equivalent [TEDE]). For an atmospheric release, TEDE is directly proportional to the total amount of the radioactive material released during the period of exposure. Therefore, when calculating how much of a radioactive material is released during a particular event, there is not much concern with the variation of the release rate over time, but only with the total quantity released during the period of assumed exposure. For releases that could go on for a long time, the assumed period of exposure is usually taken into account when determining the emergency class or protective action that is warranted. For example, if it is reasonable to assume that protective actions could be decided and implemented for a particular population within 2 hours of the start of a release, it will be useful to know the relationship between the quantity released (and the resulting dose) during that first 2 hours and the expected total release. (See also Volume II, Appendix B.)

The relevant criteria for most non-radiological hazardous materials of concern are the American Industrial Hygiene Association (AIHA) ERPG-2, or approved alternative values, expressed as “peak concentrations in air below which it is believed that nearly all persons could be exposed for up to 1 hour” without experiencing some level of health effect. The key difference is that exposure to some materials at a concentration exceeding the ERPG-2 value for a short period of time may be enough to produce the health detriment. As a result, it is recommended that these concentration criteria be compared to a calculated maximum 15-minute average concentration for purposes of deciding on protective actions. This indicates that assessment tools should determine non-radiological release rates as a function of time that will permit the calculation of maximum 15-minute average concentration at receptors of interest. For exposure periods less than 15 minutes, concentrations may be calculated over a shorter time period (e.g., the exposure duration). If the material is one for which short exposure to very high concentrations can produce severe health effects, it will be important to determine what kind of short-duration or near-instantaneous releases are possible, because these scenarios produce the highest instantaneous concentrations. (See Volume II, Appendix B.)

The basis for selection of methods and models should be well documented and include the results of any verification and validation. Consistency among models used by DOE Headquarters, offsite State/local agencies, and other site facilities that are likely to provide assistance during an emergency should be considered in model selection. It is a good idea to model a series of representative release scenarios using the site calculational methods and models. The results can then be compared to those from methods and models used by local, State, and other Federal agencies for the same scenarios. Significant differences should be identified, explained, and documented, which will help in reconciling results during an actual response. Calculational methods and models used in preparing facility Hazards Assessments and developing scenarios for drills/exercises should be identical or similar to those used in the consequence assessment process.

1.3.3 Interpretation and Communication of Results

The results of the consequence assessment process will be used by several different response elements: emergency managers; other response organizations; and local, State, and Federal agencies. They are used to verify or alter the event classification. Emergency managers rely on the results to verify and formulate protective actions for onsite personnel and protective action recommendations to offsite authorities. Notification forms carry the information to other response organizations. It is provided to local, State, and other Federal agencies for use in verifying or performing their own consequence assessments. The health and safety personnel use the results to advise and protect response personnel. Public information personnel use it to inform the media and public. Each potential user of the results has a specific set of needs and requirements. Assessment personnel should consider the needs of the end users when preparing and communicating results. Use of a standard form for presenting and summarizing inputs and corresponding assessment results is often helpful for clearly communicating results. (See Appendix B for example.) Supplemental information such as source term calculations, graphs, plume footprints, etc., can be attached to meet the needs of specific users. *Communicating information effectively to the different end users is of equal importance to technical accuracy.*

Transport and Dispersion. The end product of transport and dispersion calculations is the atmospheric concentration (and sometimes ground contamination concentrations) as a function of time and distance from the release point. Timely conversion of these concentrations to units of consequence (i.e., radiation dose or dose rate, chemical concentrations or exposures, etc.) is necessary for emergency managers to make effective use of the information.

Classification and Protective Actions. The following questions should be considered when preparing results to support event classification and protective action decision making.

- Will hazardous material(s) transport beyond the facility/site boundaries?
- When will the transport begin?
- What are the applicable protective action criteria for the material involved in the emergency?
- Will onsite/offsite impacts exceed applicable protective action criteria?
- When will impacts exceeding applicable protective action criteria begin and end?
- What are the boundaries of the areas where protective action criteria will be exceeded?
- What "evacuation" or predetermined protective action zones are impacted?
- Should the protective action or recommendation be shelter in place or evacuation?
- Will protective actions result in dose savings?

Reconciliation of Results. Consequence assessment staff should reconcile calculated results with measurements. Calculation results will, in general, *not* match measurement results because of uncertainties in *both* sets of numbers. Neither is necessarily wrong; both contain useful information for assessing an emergency and supporting the objectives of consequence assessment. But, both are also *always* uncertain to varying degrees.

- The degree to which calculation results match measurements will vary depending on the degree of match between the locations, times, and parameters; the sophistication of the modeling and data measurement techniques; and the complexity of the source, release, transport, dispersion, and deposition associated with the event. (Note: A number of studies have shown that more sophisticated systems do not always produce more accurate results.)

- The observed mismatch will be a combination of errors in measuring and modeling and include area and shape of the plume footprint, placement of the plume footprint, placement of the location of maximum impact within the plume footprint, and timing of plume passage.

- It will often not be possible to differentiate among the effects of the different errors in the overall process. The differences between calculation and measurement results will help to define the overall "envelope of uncertainty" around the estimates of consequences. The consequence assessment team should combine the results into the best overall representation of the event. Consideration of the level of confidence for each data point or group of data should be factored into the evaluation, assessment, and communication of results.

- Understanding and communicating the uncertainties associated with the consequence assessment process is very difficult and often ignored. However, it can be very important to proper decision making.

Public Information. The results to be communicated for Public Information will be determined by the Emergency Director, the Public Information Officer, or other authority within the ERO. The types of information to be communicated should be predetermined as part of the emergency management plans and implementing procedures. Consequence assessment personnel should have no direct contact with the media or public unless authorized and properly trained. Results prepared for public information may include the following types of information.

- Identification of the hazard.
- Description of the consequences.
- Locations where the consequences might occur.
- Locations where consequences might exceed protective action criteria.
- Who might be affected.
- When the effect might occur.
- The indicated protective actions.
- When protective actions should begin and/or end.
- Meteorological conditions and forecast information.

Public information should be specially formatted, worded, and graphically displayed for effective communication to a non-technical audience. This may be substantially different from the communication formats used for the ERO staff. If members of the consequence assessment staff act as "subject matter experts" for public information briefings, a simple, well-designed worksheet would provide a means for recording and transmitting textual discussion points and summaries of assessment results.

1.4 Timely Initial Assessment

1.4.1 Inputs

The three inputs required to perform a consequence assessment are source term, meteorology, and receptors. For TIA, emergency planners should do the following.

- Develop assumptions/default inputs to support rapid estimates.
- Organize assumptions/default inputs and key them to recognizable event conditions.
- Identify expected sources of real-time information to replace assumptions/default inputs.
- Make provisions for incorporating real-time information into analysis, if available.
- Identify receptor locations of interest based on initial real-time meteorological conditions.

The information listed above can be organized into a series of tools to aid personnel in making a rapid estimate of consequences based on the limited information available in the first few minutes of response. An example of how to organize the material into an easily used tool is provided in Appendix A.

Source Term. In order to meet *timely* assessment requirements, source terms should be pre-determined and documented for the full range of events and conditions expected to be encountered in the response mode. Calculation methods and resources should provide for estimating the quantitative impact of a release of hazardous materials within the EPZ. The time necessary to complete calculations should be short compared to time required to implement protective actions. Many standard methods/models for calculating consequences focus on airborne release assessments; however, other credible dispersion pathways may need to be addressed depending on the hazardous materials present and results of the facility Hazards Assessment.

Meteorology. Initial assessments are often performed by on-duty personnel prior to the activation of the emergency response consequence assessment staff. As a result, default or worst case meteorology is usually incorporated into precalculated results and TIA tools. The first pieces of real-time information that are likely to be available to responders are wind direction and speed. With minimal effort, this information can be used to modify the precalculated results to determine who is at risk and when consequences will occur. If an indicator of stability class is available, the TIA tools can be developed to allow the user to rapidly scale the dose or exposure results.

Receptors. Default and predetermined calculations used as a basis for facility-specific EALs and TIA tools incorporate worst case distances to specific receptors (e.g., nearest facility and site boundaries). Estimated consequences at these receptors support event classification and protective action decisions. Well-designed TIA tools provide the ability to extrapolate results at other receptors (see Appendix A for example). Knowledge of real-time wind direction is used to identify critical downwind receptors.

1.4.2 Calculations

During the first minutes of response, there is no time and little information or resources available to perform lengthy or complex transport calculations. Response personnel should be provided with precalculated results and/or simplified calculational methodologies.

Each facility's Hazards Assessment identifies a range of initiating events and scenarios that could lead to the release of hazardous materials. Potential consequences of each scenario are estimated and summarized in tabular form. These precalculated consequences, in conjunction with the results of other types of analyses, serve as the bases for the development of initial assessment tools. To produce an effective initial assessment tool, the assessment results should be gathered together, tabulated, and indexed for quick reference. To help the user quickly identify the most applicable precalculated result, they should also be keyed to observable conditions and EALs. Presentation of results in tabular and/or graphic format will allow the user to interpolate or more closely approximate actual conditions. The source terms on which the precalculated results are based should be briefly described so that it is possible, under emergency conditions, to select the one that is most representative of the event at hand or to apply the best modifying factors.

When simplified calculation models (e.g., hand calculations, nomograms, overlays, simple PC-based models) are developed, assumptions and default inputs to the models should be used to support rapid estimates of consequences. The data should include inputs for release rate/magnitude (source term) and atmospheric transport and dispersion conditions. Default input sets should be organized and keyed to recognizable conditions to aid users in quickly selecting the most appropriate inputs. Consequence assessment personnel should be sensitive to changes in input parameter values and be able to explain and qualify results to decision-makers.

The expected sources of real-time information that replace assumptions and default values should be identified. Provisions should be made for incorporating real-time information (e.g., instrumentation readings and sample results) into analyses as soon as it is available. Whenever possible, back-up sources of information should be identified.

All of the tools (e.g., precalculated results and simplified calculational methods) developed to support TIA should be combined into a single reference. The design of the reference should provide for easy and rapid use with minimal chance of error. For an example, see Appendix A.

1.4.3 Results

TIA results will be used in two related endeavors: (1) event classification and (2) protective action recommendations.

Event Classification. TIA supports the emergency classification decision process by providing for a direct comparison of projected consequences with the initial event categorization/classification. Facilities should ensure that TIA results are communicated in a clear, concise, and timely manner to the person with the responsibility to perform subsequent event categorization/classification.

Protective Actions. TIA results are used to determine applicable protective actions, if onsite/offsite impacts are likely to exceed applicable PAC, and when and where impacts are likely to occur. A clear and straightforward format should be developed and used for communicating results. The results should be easily and clearly connected to the specific protective actions to be implemented. A map or graphic display may also be considered, since a "picture" of the affected areas may lend clarity.

1.5 Continuous Assessment

As the consequence assessment staff is activated and TIA activities are completed, the continuous assessment process begins. The goal is to use all currently available information and data to continuously refine the assessment to improve accuracy, reduce uncertainty, and improve understanding by using better input information, more sophisticated models, and the expertise of subject matter experts. Tasks include (1) re-evaluating event classification; (2) re-evaluating protective actions/recommendations; (3) initiating and confirming health and safety decisions for responders; (4) coordinating results with offsite consequence assessment teams; and (5) performing "what if" estimates in anticipation of changing conditions. In the later stages of response, the continuous assessment process can provide information to support a termination decision and initial recovery planning. Continuous assessment is performed in a cyclic fashion (see

Figure 1.2), incorporating the most current data and information into each cycle. During planning and preparedness activities, emergency planners should do the following.

- Establish procedures for incorporating event-specific data into analyses as it becomes available.
- Identify alternative methods for gathering input information.
- Develop a method for verifying the accuracy of data and information received by the consequence assessment team.
- Establish a standard communication protocol for communication of data/information and results to minimize the propagation of errors.
- Include a process to perform a quality assurance check on assessment results and establish degree of uncertainty prior to distribution.
- Establish a method to compare results and resolve differences between response organizations.
- Understand the capabilities of DOE radiological emergency response assets and plan for incorporation into the assessment process (see Volume VIII.
- Work with the public information staff to identify the format, content, and level of detail of information required to support public information activities.
- Identify and train technical personnel to present results to the media and public.

1.5.1 Inputs

As with the TIA, procedures need to be established for incorporating event-specific data into analyses as such data becomes available. Methods and instrumentation should be identified to determine the status of affected systems, release parameters, and environmental conditions. The methods and instrumentation should be specific to the point of release, pathway, and material of concern. Methods and equipment should be referenced and incorporated into consequence assessment procedures, considering the following.

- Identify and reference in procedures any methods or documents that could be used to determine potential source-term (hazardous material) inventories.

- Establish correlations between monitoring instrument readings and concentrations, cumulative exposure/dose, and/or exposure/dose rate at specific receptors.

- Identify instrumentation that estimates but does not directly measure quantity or concentration of released or stored material (e.g., building air monitors, pressure indicators on storage tanks); document correlations between instrument readings and quantities of interest.

- For identified instrumentation, provide all necessary conversion factors or techniques.

- Develop methods to acquire and use real-time meteorological parameters and meteorological forecast conditions.

1.5.2 Calculations

During continuous assessment, the consequence assessment team should use models or methods to improve the quantitative accuracy of consequence estimates. The methods may be the same as those used during initial assessment.

Depending on the hazard level, the methods used may not need to be more sophisticated then those used during TIA. However, during continuous assessment, real-time information is used as available in the calculational methods.

For moderate- to high-hazard facilities, computer-based modeling systems are used to increase the accuracy of the estimates. Typical computer-based modeling systems have more features; are the only means available to characterize wind fields in complex regions of transport; use more sophisticated, flexible, detailed, or accurate input information; and produce more sophisticated, detailed, or accurate output products. However, they require more time, knowledge, skill, and training to use effectively.

In general, a site/facility should design and employ the simplest consequence assessment system (manual or computer-based) that will meet its goals for accurately characterizing transport and dispersion conditions in support of emergency response.

Advanced models/methods should have the ability to estimate consequences at a large number of receptors, including those selected by the user.

1.5.3 Results

During the continuous assessment process, the assessment team should use its judgment to combine the calculated and measurement results into the best possible overall picture of the consequences. To effectively communicate and utilize the results, the types and format of information needed by each response element should be pre-determined as part of the emergency plan and implementing procedures.

1.6 Integration, Coordination, and Quality Assurance

1.6.1 Integration with Emergency Classification and Protective Actions

Calculation models and methods should provide estimates of concentrations, integrated exposures, and exposure rates from released materials at selected receptor points. Estimates of consequences should be in units or terms that correspond to those used in EALs and for determining protective actions. For example, calculated consequences at distances corresponding to facility and site boundary receptors should be compared to protective action thresholds. The distance at which a protective action level would be exceeded should be determined and reported to ERO management. For determining appropriate protective action, models and methods should project integrated consequences based on current and predicted conditions of release duration, source term, and dispersion.

The facility-specific EAL set should include criteria which are stated in terms of consequence assessment results. Normally, EALs based on consequence assessment results should not be considered the primary classification criteria, but they will serve as supplements to more directly observable event indicators.

1.6.2 Coordination of Information

Plans and procedures should address a protocol for sharing and transmitting information among response organizations. This protocol should address the units of measure for quantities or parameters of interest including concentration, cumulative exposure/dose, and exposure/dose rate. The units of measurement used in communication and documentation should be the same as those commonly used in the emergency management community. To avoid confusion and misinterpretation in the process or results of consequence assessment, coordination of units and measurements should be proceduralized and agreed upon with interfacing onsite and offsite organizations in advance.

Plans and procedures should address recording the parameter values and information used in a consequence assessment calculation. These values should be posted as current status and transmitted to other response organizations. The means for logging, displaying, and analyzing the trend of data relevant to consequence assessment should support the decision-making process for both onsite and offsite organizations.

At least annually, DOE emergency planners should meet with all planning partners to discuss items that affect consequence assessment, such as the following.

- Changes to site/facility hazards.
- Notification.
- Calculation models and methods.
- Communication methods.
- Terminology.
- Presentation of results.
- Changes in monitoring systems, techniques, or capabilities.

1.6.3 Quality Assurance

Quality control of the tools used in consequence assessment, such as the meteorological monitoring system hardware and software, dose modeling hardware and software, etc., should be employed in a manner similar to the control exercised over the procedures used in consequence assessment activities. The reasons for a quality program are many; for example, consequence assessment results and personnel protection may be impacted by faulty modeling or meteorological data, real-time systems demand a high percentage of data availability, etc. A planned and systematic pattern should be employed that provides adequate confidence that consequence assessment tools conform to established operational, functional, and technical requirements. The sophistication of the quality assurance program for consequence assessment tools should be commensurate with facility-specific hazards. Several references are provided regarding meteorological systems, computer systems, and quality programs.

Contractors subject to DOE rule 10 CFR 830.120 and DOE 5700.6C should add their quality assurance requirements associated with the emergency management system into their existing quality assurance program and implementing procedures.

Operational considerations relate to reliability and survivability and should include such features as uninterruptable power supplies, back-up components or methods, and rapid response maintenance. The consequence assessment, computer-based modeling, or meteorological systems need to be available and functional during an emergency. Adverse conditions affecting power continuity, ventilation, etc., are most likely to occur during the time of emergency; thus, adequate planning for contingencies is necessary.

A systematic approach based on needs analysis should be employed in the development, operation, maintenance, and retirement of software and hardware to ensure that functional requirements are met. Consistency with models used by other facilities that are likely to provide assistance during an emergency, DOE Headquarters, and offsite State/local agencies should be considered in model selection.

Technical requirements should be established that provide for documentation of software code, maintenance of hardware, verification/validation of the consequence assessment system, and configuration control of the system after inauguration. Methods and models used in consequence assessment should be documented in such a manner that the analyses and results can be critically reviewed, understood, and, if necessary, reconstructed by independent experts. Detailed descriptions of the assumptions, methods, and models should be documented in a form that may be referenced (e.g., published technical reports or vendor manual).

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APPENDIX A
EXAMPLE TIMELY INITIAL ASSESSMENT TOOL

A.1 Introduction

The purpose of this appendix is to illustrate the use of the example Hazards Assessment results, presented in Volume II, Appendix D, to produce a tool to aid in performing timely initial consequence assessment.

Section 1.4 of this chapter on Consequence Assessment discusses the concept of timely initial assessment. Several pre-calculated and simplified calculational techniques are described. Each is discussed briefly and in sufficiently general language to be applied to a broad variety of facility types. It is believed that the intent of the guidance can be made much clearer by use of an example. This example utilizes the results of the example Hazards Assessment, presented in Volume II, to create a TIA tool.

This appendix is presented in the form of a document titled an "Emergency Assessment Resource Manual" (EARM). For the hypothetical DOE site Erlenmeyer, the EARM represents a sitewide TIA tool consisting of multiple sections, one for each facility that required a Hazards Assessment. To make the reference easy to use, each section would be tabbed or labeled for easy access and would contain the same type of information presented in the same format. The example presented here represents the section from the EARM which has been prepared for the hypothetical Mixed-Waste Universal Plastic Process Pilot Plant (MWUPPPP) housed in the ABC Facility on the Erlenmeyer site. [The complete example EARM can be found in the course material for the Workshop on Consequence Assessment for Emergency Response, sponsored by NN-60.]

A.2 Example Emergency Assessment Resource Manual (EARM)

The format and content of the example, presented in the following pages, should be viewed as one of many possible methods for utilizing the results of the Hazards Assessment process and other relevant analyses to create an aide for performing TIA.

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Mixed-Waste Universal Plastic Process Pilot Plant
Emergency Assessment Resource Manual

1. First Responder Information

1.1 Current Operations

The MWUPPPP receives mixed transuranic waste from decontamination and decommissioning (D&D) operations on the Erlenmeyer site, processes it to reduce its volume and destroy certain organic contaminants, and incorporates it into a durable plastic matrix for storage and disposal. The waste contains plutonium-238, heavy metals, and residues of various chemical munitions agents.

1.2 Nearest Site Boundary

The nearest site boundary is the near bank of the Big Lazy River, 300 m east and southeast of the ABC Building.

1.3 Summary of Radioactive Materials

The radioactive material inventory of the MWUPPPP is essentially all (~99 percent) Pu-238 as contamination in bulk waste being processed and in the stabilized (product) form. The Pu-238 is in the form of a very insoluble (Class Y) oxide, with particle size ranging from sub-micron to more than 75 micron AMAD. Table 1.1 presents a summary of the consequences of analyzed events and conditions involving radioactive materials.

1.4 Summary of Nonradioactive Hazardous Materials

The only nonradioactive hazardous material found in the MWUPPPP in quantities exceeding the screening threshold is toluene-2,4-diisocyanate (TDI). TDI is received in drums and used in the formulation of a plastic matrix to stabilize and contain the hazardous waste residue. Table 1.2 presents a summary of the consequences of analyzed events and conditions involving TDI.

Table 1.1. Radiological Accident Consequences.

Event/Condition	Facility Boundary[1] Dose[2] (rem)[3]	Site Boundary[4] Dose[2] (rem)[3]	Distance to 1 rem PAC[2] (km)	Emergency Class
Product Extrusions (4) Burn, Unfiltered Ground Level Release	730	51	1.5	General Emergency
Product Extrusion (1) Burns, Unfiltered Ground Level Release	180	13	0.85	General Emergency
Incinerator Explosion, Unfiltered Ground Level Release	3.7	0.25	0.22	Site Area Emergency
Spill of Waste Drum Outside	2.7	0.19	0.2	Site Area Emergency
Breach of Process Enclosure, Unfiltered Ground Level Release	0.15	0.01	<0.1	Alert[5]

1: For analysis purposes, defined 100 m radius from release point.
2: PAC=protective action criterion; at 1 m/s and Pascal F stability.
3: Total Effective Dose Equivalent (TEDE)=Effective Dose Equivalent + Committed Effective Dose Equivalent (EDE+CEDE).
4: At nearest site boundary (300 m east).
5: Based on exceeding 1/10 of protective action criterion at facility boundary (100 m).

Table 1.2. Nonradiological Accident Consequences.

Event/Condition	Facility Boundary[1] Concentration[2] (ppm)	Site Boundary[3] Concentration[2] (ppm)	Distance to 0.02 ppm PAC[2] (km)	Emergency Class
TDI leak/spill outside with fire that engulfs drum	3.0	2.7	9.1	General Emergency
TDI leak/spill outside with fire, drum not involved in fire	0.60	0.54	2.7	General Emergency
TDI leak/spill outside, no fire	0.51	0.12	0.93	General Emergency

1: For analysis purposes, defined as 100 m from release point.
2: PAC=protective action criteria; at 1 m/s and Pascal F stability.
3: At nearest site boundary, 300 m east.

2. Receptor Locations

Table 2.1 lists the distances to significant receptors in each direction (sector) from the ABC Facility and the travel time for an airborne plume to reach that receptor at a wind speed of 1 m/s.

Table 2.1. Distances to Receptors From ABC Facility.

Wind From	Downwind Sector	Threatened Receptor	Distance (km)	Plume Travel Time (min) at 1 m/s
N	S	Site Boundary	0.7	12
	S	Happy Cow Dairy	2.4	40
	S	Anytown School	6.5	108
NNE	SSW	Visitor Center	0.43	7
	SSW	Site Boundary	0.8	13
	SSW	Industrial Park	4.6	77
	SSW	Anytown Town Center	12.5	208
NE	SW	Site Boundary	0.95	16
	SW	Broken Arrow Scout Camp	2.0	33
	SW	Any Town Center	12.0	200
ENE	WSW	Highway 99	0.98	16
	WSW	Site Boundary	1.1	18
	WSW	Broken Arrow Scout Camp	2.1	35
	WSW	Gotham City Limit	18.5	308
E	W	Highway 99	0.93	15
	W	Site Boundary	1.6	27
	W	Site EOC	10.1	168
	W	Gotham City Limit	17.7	295
ESE	WNW	123 Area EOC	1.2	20
	WNW	G Area Tank Farms	5.2	87

Table 2.1. Distances to Receptors From ABC Facility (continued).

Wind From	Downwind Sector	Threatened Receptor	Distance (km)	Plume Travel Time (min) at 1 m/s
ESE (cont'd)	WNW	Site Boundary	12.6	210
	WNW	Fort Phosgene Admin Area	13.2	220
SE	NW	D Area	7.9	131
	NW	Site Boundary	12.4	207
	NW	Fort Phosgene Admin Area	13.2	220
	NW	Tribe Town	16.1	268
SSE	NNW	F Area	4.3	71
	NNW	Site Boundary	7.9	131
	NNW	A Area	13.4	224
S	N	Labs Facility	0.4	7
	N	Site Boundary	4.9	82
	N	Stunted Pines Park Ranger Station	13.4	224
SSW	NNE	Labs Facility	0.4	7
	NNE	Site Boundary	4.2	70
	NNE	West Podunk City Limit	11.3	188
SW	NE	Labs Facility	0.5	8
	NE	Site Boundary	0.6	10
	NE	Highway 99	5.2	87
	NE	East Podunk City Limit	13.1	218
WSW	ENE	Site Boundary	0.37	6
	ENE	C Facility	2.0	33
	ENE	Rutabaga County Line	6.9	114
W	E	Site Boundary	0.3	5

Table 2.1. Distances to Receptors From ABC Facility (continued).

W (cont'd)	E	C Facility	2.0	33
	E	Rutabaga County Line	6.6	
WNW	ESE	Site Boundary	0.3	5
	ESE	State Fish Hatchery	2.9	
NW	SE	Site Boundary	0.35	6
	SE	Second Nearest Residence	3.1	52
	SE	Wheresville State Home for Dweebs	15.2	253
NNW	SSE	Building 999	0.35	6
	SSE	Site Boundary	0.45	8
	SSE	Nearest Residence/Lazy River Dairy	2.4	40

3. Accident Scenarios

This section provides radiological and/or hazardous material consequences for seven scenarios, as follows.

3.1 TDI Spill Outside

3.2 TDI Spill/Fire Outside

3.3 TDI Spill/Fire Engulfs Drum, Outside

3.4 Waste Drum Spill Outside

3.5 Breach of Process Enclosure (HVAC Lost)

3.6 Incinerator Explosion (HVAC Lost)

3.7 Fire Involving Product Extrusions (HVAC Lost)

[Note: For the purposes of this appendix only information for scenarios 3.1 and 3.7 will be presented. For each accident scenario identified the following subsections present the same type of information in a standard format.]

3.1 TDI Spill Outside

Once leaked from the drum, the vaporization rate will be directly proportional to the wetted area. Analysis of a range of different leak sizes and locations indicates that wetted area from a single drum that is punctured outside the ABC Building could theoretically exceed 750 m^2, with the most probable maximum being about 300 m^2.

3.1.1 Source Term

The rate of vaporization of TDI from a spill is a function of ambient temperature, the temperature (and type) of the surface on which it is spilled (the pavement), the temperature of the TDI when it is spilled, and the air velocity moving over the spill. Of these, the TDI temperature and the surface temperature are the most significant. The conservative case selected for the source term calculation is typical of summer conditions, i.e., high ambient and surface temperatures. Conditions typical of other seasons were also analyzed and the vaporization rates are presented in Table 3.1 below. If the actual conditions at the time of a release correspond more closely to one of the other reference conditions, the multiplier in the last column can be used to scale down the consequence estimates presented in this section.

Table 3.1. Source Term Estimates For TDI Spill Outside.

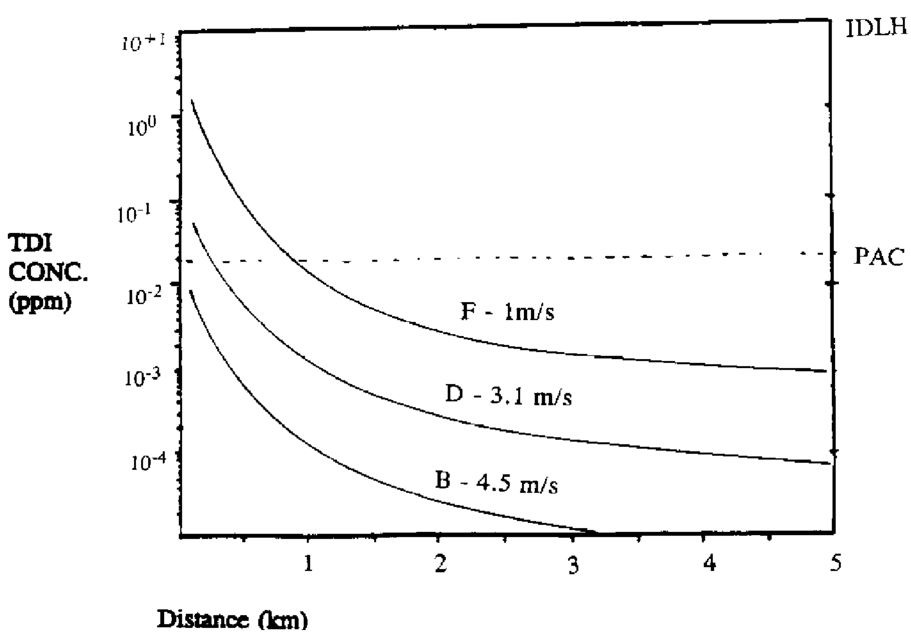
TDI Vaporization			
Case	**Conditions**	**Rate (kg/s)**	**Multiplier**
Hot - Summer (conservative)	TDI Temp = 90°F Air Temp = 90°F Surface Temp = 130°F	0.00018	1
Warm - Spring/Autumn	TDI Temp = 65°F Air Temp = 65°F Surface Temp = 85°F	0.00011	0.6
Cool - Spring/Autumn	TDI Temp = 45°F Air Temp = 45°F Surface Temp = 45°F	0.000032	0.2
Cold - Winter	TDI Temp = 40°F Air Temp = 25°F Surface Temp = 20°F	0.000011	0.06

3.1.2 Protective Action Criteria Distances

Table 3.2. Protective Action Criteria Distances for Different Meteorological Conditions Based on the Conservative Vaporization Rate.

Stability Class	Assumed Wind Speed (m/s)	Dist. at Which Protective Action Criteria (0.02 ppm) Exceeded (km)	Dist. at Which IDLH (10 ppm) Exceeded (km)
A	4.5	<0.1	<0.1
B	4.5	<0.1	<0.1
C	3.1	0.12	<0.1
D	3.1	0.17	<0.1
E	1.0	0.48	<0.1
F	1.0	0.93	<0.1

3.1.3 Concentration versus Distance for Different Meteorological Conditions



Information for accident scenarios 3.2-3.6 would be presented here.

3.7 Fire Involving Product Extrusions With Loss of HVAC

The plastic product will burn if subjected to temperatures above 205°C in the presence of air. Burning of the plastic with its included Pu aerosol is expected to cause about 25 percent of the aerosol to become airborne.

3.7.1 Source Term

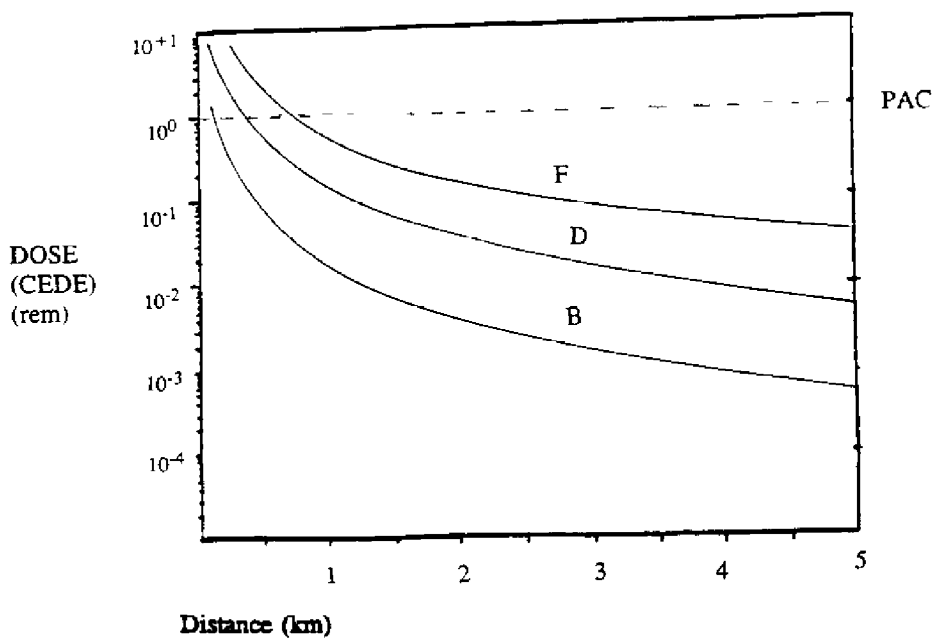
Burning a single product extrusion will release 2.5E+5 µCi Pu to the room atmosphere, of which 30 percent (7.5E+4 µCi) ultimately could be released to the atmosphere at ground level through doors, seals, and building penetrations if the HVAC exhaust is not functioning. Burning of the maximum inventory (in any single bay) of four product extrusions could release 3E+5µCi over a period of 2 hours.

3.7.2 Protective Action Criteria Distances

Table 3.8. Protective Action Criteria Distances for Different Meteorological Conditions Based on Release of 3E+5 µCi Pu-238 at Ground Level.

Stability Class	Assumed Wind Speed (m/s)	Dist. at Which 1 Rem Protective Action Criteria Exceeded (km)	Dist. to Early Lethality Threshold (km)
A	4.5	0.27	<0.1
B	4.5	0.40	<0.1
C	3.1	0.71	<0.1
D	3.1	1.15	<0.1
E	1.0	1.40	0.2
F	1.0	1.50	0.2

3.7.3 Dose Versus Distance for Different Meteorological Conditions (Four Product Extrusions Burned)



APPENDIX B
EXAMPLE FORMS AND CHECKLIST

CONSEQUENCE ASSESSMENT RESULTS FORM

Consequence Assessment Team No.

Time: _____ Initialed by Assessment Manager ________

Hazards Evaluation Results				
Projected Consequences:				
#	Location	Downwind Distance (miles/Km)	ETA	Exposure Level
1				
2				
3				
4				
5				

Protective action criteria exceeded out to _____ (miles/Km).

Bases/Assumptions used for the above estimates:

[Note: If available, the following types of information might be included: type of material released, quantity of material estimated, release point, release height, wind speed, wind direction, stability class, and applicable protective action criteria.]

RECOMMENDATIONS

Event Classification

☐ Alert ☐ Site Area Emergency ☐ General Emergency ☐ Termination

Recommended Protective Actions

Area/Site:

Offsite:

ERLENMEYER SITE ERO
CONSEQUENCE ASSESSMENT - CHECKLIST

1. Obtain a copy of the initial Event Notification Form from the occurrence notification communicator.

2. From the Data Display Terminal located in the Assessment Team work area, obtain current meteorological data from the monitoring tower nearest to the reported event location. If the information is not available from the Data Display Terminal, contact the D Facility control room on 5-2121 and request current data. Record data in Section 1 of Attachment 1.

3. Obtain the section of the Emergency Assessment Resource Manual (EARM) appropriate for the facility involved in the event.

   a. Identify the accident scenario which most closely resembles the event description from the initial notification information.

   b. From the appropriate table, obtain the site boundary concentration/dose, distance to protective action criteria, and event classification for the worst case conditions. Record this information in Section 2 of Attachment 1.

   c. Using the concentration/dose curves provided in the EARM and the current stability class, estimate the concentration/dose at the facility boundary and the nearest downwind site boundary. If the initial notification contained information on source term, create a scaling factor to modify your estimate. Record information in Section 3 of Attachment 1.

4. If the Emergency Director has arrived, provide an initial briefing using information collected on Attachment 1.

5. As soon as the Incident Command Post (ICP) has been activated, establish communications with the Health and Safety Representative. Begin data entry and updating of Status Boards.

6. Using the results from step 3.c. above, identify the affected area. Plot the affected area on the status board map. Compare these results with protective actions that may have already been ordered by the Incident Commander. Bring any urgent need for additional protective actions/recommendations to the immediate attention of the Emergency Director.

7. Compare the emergency class determined in Step #3 with any emergency classification decision that may have been reached by the Incident Commander. Bring any differences to the attention of the Emergency Director.

8. Using the appropriate computerized atmospheric dispersion model (e.g., Chemical Model or Radiological Model) and the most current meteorological and source term data, perform a comprehensive concentration/dose projection. Use these results to re-evaluate protective action and event classification recommendation. Update Attachment 1, attach computer output, and brief Emergency Director as necessary.

9. Establish communications with the Erlenmeyer site, county, and State EOCs, if activated. Provide them with current information/data, results of analyses, and technical assistance as requested.

10. If it has been determined that field monitoring is necessary:

    a. Direct the Environmental Surveillance Coordinator to form two field teams and report when they are ready to be briefed and dispatched.

    b. In coordination with any other organizations that will be dispatching field teams, develop a monitoring strategy.

    c. Establish communications with and control over site teams. Begin team tracking and data transmission, logging and display.

    d. Establish necessary communications with other organizations to acquire data from their teams. Process data as necessary (e.g., conversion, correction factors, etc.) and integrate with site team data.

    e. Obtain and interpret analysis results from any field samples sent to the analytical lab.

11. Compare field sample/measurement results with concentration/dose estimates. Revise and/or refine projections as possible. Prepare and distribute updated Attachment 1 as necessary.

12. If the release is projected to last longer than 2 hours, obtain forecast meteorological information and perform a plume projection. Identify the potentially affected areas and appropriate protective actions.

13. In response to significant changes in meteorological conditions, updated source term information, field monitoring/sampling results, and requests for specific projections,

perform periodic concentration/dose calculations. Develop associated protective actions and classification. Repeat this process as necessary.

14. As requested, assist State and local agencies in assessing impacts due to other exposure pathways (e.g. drinking water, food supply, outdoor activities, etc.).

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ATTACHMENT 1
CONSEQUENCE ASSESSMENT SUMMARY

Time:_____

1. Current Meteorology:

   a. Event location ____
   b. Wind speed (m/s)____
   c. Wind direction (from) ____
   d. Stability class ____

2. EARM Consequence Estimate (worst case source term, severe meteorology)

   a. Event/scenario type ____
   b. Nearest site boundary (direction and distance) ________________________
   c. Maximum consequence at site boundary ________________________
   d. Distance at which Protective Action Criterion exceeded ________________
   e. Emergency class ____
   f. Remarks____
   ____

3. EARM Consequence Estimate (best estimate source term, current meteorology)

   a. BEST ESTIMATE of source term ________________________________
   b. DOWNWIND site boundary (direction and distance) ____________________
   c. Consequence at DOWNWIND facility boundary ______________________
   d. Consequence at DOWNWIND site boundary ________________________
   e. Distance to Protective Action Criterion under CURRENT CONDITIONS __________
   f. Emergency class based on consequence and distance ____________________
   g. Remarks ____
   ____

4. Consequence Estimate (from computer model).

   a. BEST ESTIMATE of source term ________________________________
   b. DOWNWIND site boundary (direction and distance) ____________________
   c. Consequence at DOWNWIND facility boundary ______________________
   d. Consequence at DOWNWIND site boundary ________________________
   e. Distance to Protective Action Criterion under CURRENT CONDITIONS __________
   f. Emergency class based on consequence and distance ____________________
   g. Remarks ____
   ____

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2. PROTECTIVE ACTIONS AND REENTRY

2.1 Introduction

Protective Actions are measures, such as evacuation or sheltering, taken to prevent or minimize potential health and safety impacts on workers, responders or the public. These measures are common for both Base Programs and Hazardous Material Programs. Typically, evacuation and sheltering are the primary protective actions considered for use in Base Programs. For Hazardous Materials Programs, additional protective actions such as decontamination, access control, shielding, and others may also be applicable.

Reentry is a planned activity to accomplish a specific objective(s) set by the Emergency Response Organization (ERO), conducted prior to the termination of emergency response, which involves reentering a facility or affected area that has been evacuated or closed to personnel access during the course of the emergency. Reentry activities are time-urgent actions performed during emergency response such as search and rescue, mitigation, damage control, and accident assessment. Some activities performed during recovery are similar to those performed during reentry in that they may involve entering a facility or affected area in which hazardous materials have been released. Therefore, some of the considerations discussed in the reentry section below may also be applicable to recovery operations (See also Volume IV, Chapter 6.)

This chapter provides an overview of the protective action process, including developing criteria for protective actions, determining pre-planned protective actions, and incorporating protective actions into emergency plans and procedures; a system for implementing protective actions during an emergency is also addressed. Protective actions taken during the response to an emergency, such as accountability, protection of workers from hazardous materials, and decontamination, are also covered in this chapter. Planning for and conduct of reentry activities is discussed. Although the focus of the discussions is toward Hazardous Materials Programs, the content is also applicable to Base Programs.

Base Program. The minimum protective action requirements for Base Programs specified in the Order includes plans for evacuation or sheltering of employees, along with provisions to account for employees after emergency evacuation has been completed. If the Base Program site/facility has hazardous materials, though not in significant quantities, the protection of workers involved in response and clean-up is covered by 29 CFR 1910.120. Reentry planning includes contingency planning to ensure the safety of reentry personnel, such as planning for the rescue of reentry teams. All individuals involved in reentry are to receive a hazards/safety briefing prior to emergency response activities, consistent with Federal, state, and local laws and regulations.

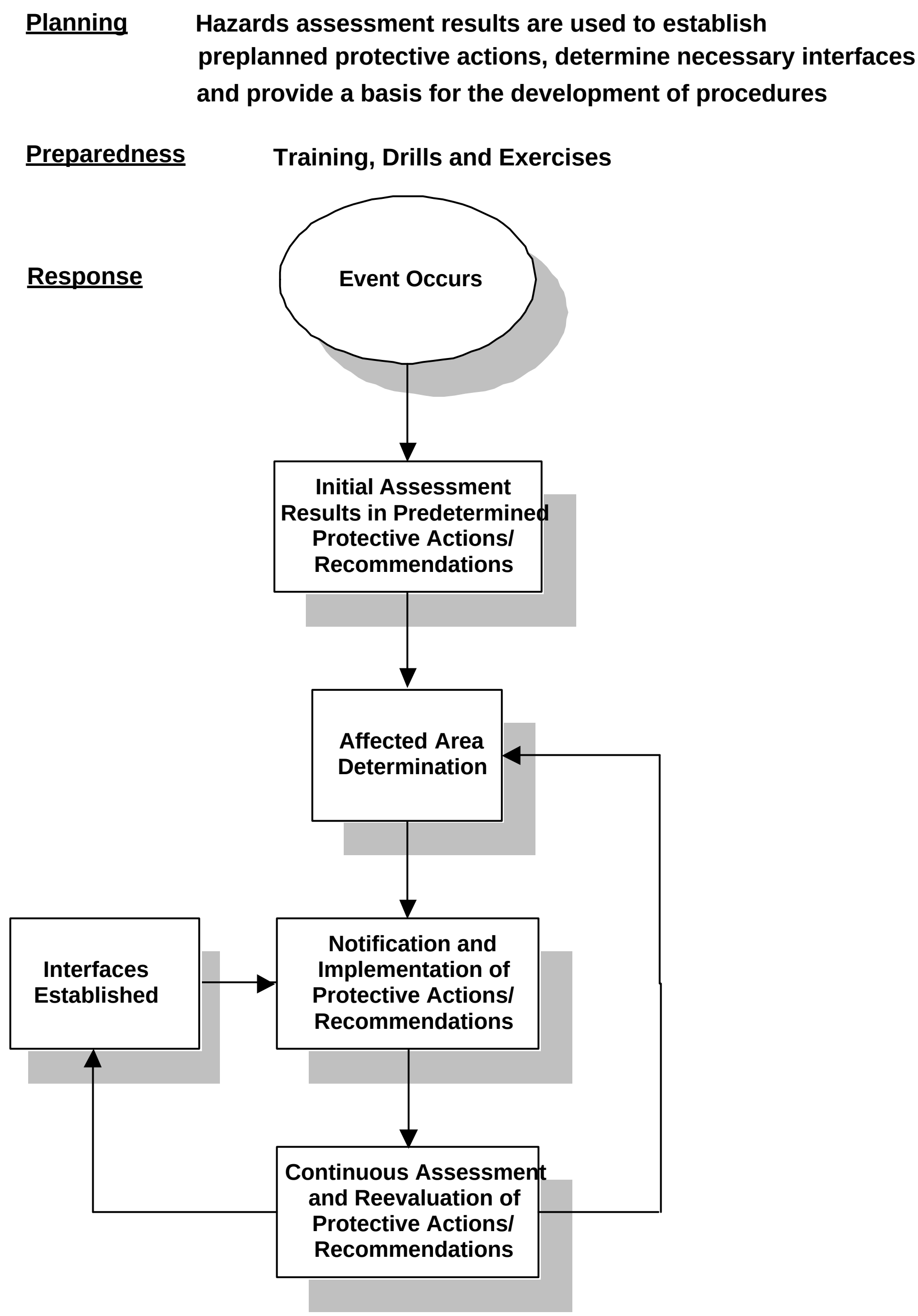
2.2 Protective Action Process

The process for developing protective actions is part of emergency management planning and is one of the direct applications of the results from the Hazards Assessment. The process begins with development of preplanned protective actions. These are often directly linked to the categorization/classification process so that the issuance of protective actions is automatic upon declaration of an Operational Emergency. Next is the determination of who needs to be notified and provided information in order to take protective actions, to implement protective actions and to respond safely. The next step in planning for protective actions is developing plans and procedures for protective actions. Establishment of the ERO staff that will be responsible for determining, recommending and implementing protective actions is the last step of the planning process for protective actions.

Training, drills, and exercises conducted for the ERO staff responsible for protective actions comprise the preparedness phase of emergency planning for protective actions.
Preplanned protective actions will be implemented in the very early part of an event, when little information is known about the severity of an incident. Actions need to be taken quickly to protect workers and/or the public. Figure 2.1 shows how the process for protective action determination begins with use of preplanned protective actions. In general, the protective actions of sheltering and evacuation are the same for Base Program facilities as for the Hazardous Materials Programs but are usually only implemented for a localized area, such as a building or facility. Additional types of protective actions are often not warranted for Base Program facilities. The criteria for developing protective actions is discussed in Section 2.3.1.

As seen in Figure 2.1, once continuous consequence assessment is started and additional information is acquired about the event, including the actual release and status of mitigation of the event, reevaluation of protective actions will begin. The reevaluation of protective actions/recommendations is a product of continuous consequence assessment and is performed throughout the response (also see Volume IV, Chapter 1.) The evaluation of habitability for areas being used by responders and sheltered personnel is part of the continuing evaluation for protective actions.

Figure 1. Process of Protective Action Determination



Next is the determination of affected area(s). This topic is discussed in Section 2.3.2. The affected areas may be adjusted as additional information is obtained during an event.

The next step in the process is providing necessary notifications for onsite responders and workers needing to take protective actions and to offsite officials responsible for protecting the public. Notifications are discussed in detail in Volume III, Chapter 4.

2.3 Protective Action Planning

The basis for planning protective actions begins with the Hazards Assessment and analysis. Once the level of hazard is identified and the consequences of a release are identified, the actions necessary to protect the health and safety of the workers and the public can be established. Determining when protective actions are necessary and where those actions must be implemented is the primary concern when planning protective actions.

2.3.1 Protective Action Criteria

Protective action criteria are the predetermined concentrations, doses, or exposures at which protective actions will be initiated.

General. Emergency plans for DOE sites/facilities should identify the methodology to be used to develop criteria for protective action decision making. Emergency procedures for implementing protective actions should incorporate these criteria. For each specific hazardous material identified during the Hazards Assessment process, the numerical criteria should be expressed in units that can be readily correlated with both the potential for health impact (e.g., peak concentration, cumulative dose or exposure) and information that will be available to decision makers during an emergency event, such as observable event indicators, results of consequence calculations, or measurements.

- For planning purposes, all facilities and activities on a given DOE site should use the same protective action criteria for a particular hazard. Also, the same protective action criteria should be applied to onsite and offsite personnel.

- Facility indicators and operating parameter values corresponding to hazardous material releases that will exceed protective action criteria should be identified. They should be incorporated into facility response criteria and/or emergency action levels (EALs) to ensure that the need for prompt protective action is recognized by the person(s) responsible for determining the emergency class and initiating the emergency response.

- Two or more protective action criteria may apply to a particular event or condition (e.g., a mixture of several chemicals or a chemical agent and a radioactive material released together). Unless the combination has been characterized and is known to be more toxic than any of the materials in the mixture, protective action decisions (and recommendations) during the early phase of an event should be based on the substance that comes closest to exceeding its respective criterion.

- The same protective action criteria should be used for onsite transportation activities as for fixed facilities. However, it should be recognized that for transportation events occurring offsite, local authorities may take action independent of DOE based on other criteria. Many offsite authorities rely on the *North American Emergency Response Guidebook* for determining protective action for transportation events involving hazardous materials.

Criteria For Radiological and Non-radiological Releases. The Order specifies that the Protective Action Guides (PAGs) published by the Environmental Protection Agency (EPA) and the Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association (AIHA) are to be used for comparison with exposures resulting from hazardous material releases to determine the appropriate emergency class and associated protective actions. PAGs and ERPGs are sometimes referred to generically and collectively, in this Emergency Management Guide (EMG) and elsewhere, as protective action criteria (PAC). A complete discussion of the definition and use of PAC is presented in Volume II, Appendix B.

2.3.2 Determination of Affected Area

Knowledge of the geographic area within which PAC has been (or will be) exceeded is necessary for decision makers to effectively apply those criteria.

Knowledge of the geographic area includes the identification of all receptors of interest for planning protective actions (see Volume IV, Chapter 1.) Timely initial or continuous assessment estimates are used to provide information for protective action decisions.

Consequence calculations and field measurements should be used to define the area affected by a hazardous material release. Real-time consequence projections may be calculated during a release event, or calculations may be performed in advance for various combinations of release magnitude and dispersion conditions, and the results tabulated for easy reference.

Field measurements should be used to confirm the results of calculations and to refine estimates of the affected area. Reliance on field measurement results as the primary basis for protective action decisions should be limited to those materials and exposure pathways for

which protective action criteria are not likely to be approached in the time necessary to take measurements and analyze the results (such as food pathways).
The facility/site emergency plan for determining the affected area should be coordinated with the plans of offsite officials to ensure mutual understanding of the methods to be used, the type of results likely to be obtained, and the bases for any protective action recommendations that DOE may issue. If the DOE activity and the offsite authorities use different calculational models or measurement methods, differences should be examined and understood during the planning process to ensure that they do not cause confusion or delay in selecting or executing protective actions.

The facility/site emergency plan should provide for integrating the monitoring assets of other offsite agencies, such as regional and national Federal assets (i.e., Federal Radiological Monitoring and Assessment Center, Aerial Measuring Systems, etc.) The plan should also include instructions for requesting radiological emergency response assets and the management approvals needed to make such a request.

2.3.3 Reentry Planning

The facility-specific Hazards Assessment should be the principle resource for determining the range of conditions that need to be considered for reentry planning.

The identification and screening of facility hazards will identify the material hazards that may be encountered during reentry activities. A review of the event scenarios developed during the Hazards Assessment will provide the planner with information concerning the type and nature of possible failures; possible mitigative activities; areas likely to be accessed during reentry; degree and nature of facility damage; and, systems, indicators, or controls which may be non-functional. The consequence estimation process will provide source term information for each event scenario which will help the planner determine the range of hazardous environments that may be encountered by personnel during reentry activities.

The information provided by the facility-specific Hazards Assessment will identify potential reentry activities and help the planner determine the needed support materials and resources. Using information generated during the Hazards Survey or Assessment, facility operations personnel should consider the following: special damage control equipment, provisions for spare parts, availability of back-ups for critical equipment, pre-arranged service contracts, and accessibility of critical items (e.g., controls, indicators, systems, tools and equipment) under emergency conditions. (See also Volume IV, Chapter 5, for information concerning facilities and equipment necessary to support reentry activities.)

2.4 Protective Actions Implementation

The International Commission on Radiological Protection (ICRP) has issued recommendations and guidance on planning for protective actions. The objectives and principles described by the ICRP, and endorsed by the International Atomic Energy Agency (IAEA), are specific to radiological accidents, but are also useful in planning protective actions for hazardous material programs in general. These principles are:

- Severe early health effects should be avoided by taking protective actions to limit individual doses or exposures to levels below the threshold for those effects;

- The risk to individuals should be limited by taking protective actions which produce a positive net benefit to the individuals involved, i.e., the risk to the individual from taking the protective action is lower than the risk from exposure or dose that is thereby avoided; and

- The overall risk to workers and the public should be limited, to the extent practicable, by reducing the population or collective dose (or exposure). The ICRP guidance suggests that dose to emergency workers is as important as dose to the general public in adhering to this principle.

The World Health Organization (WHO) and the ICRP have identified protective actions that can be implemented individually, or in combination, to reduce exposures from a wide range of hazardous material types. These include:

- evacuation,
- sheltering,
- decontamination of people,
- medical care,
- ad hoc respiratory protection,
- control of access,
- shielding,
- radioprotective prophylaxis (e.g. administration of stable iodine),
- control of foodstuffs and water,
- relocation,
- decontamination of land and equipment,
- changes in livestock and agricultural practices.

2.4.1 Evacuation and Sheltering of Workers

Evacuation and/or sheltering are likely to be the most effective protective actions that can be taken to minimize risk to workers close to the event scene. Workers closest to the scene of an emergency will be subjected to the highest risk from the effects of the accident conditions with the least warning time.

Facilities should ensure that their communications systems allow rapid communication of protective actions to all affected workers. A method should be employed that ensures emergency managers that affected workers have been warned and are implementing protective actions.

Facility plans and procedures should include criteria for evacuation or sheltering of workers. These criteria may be related to event categorization or the declaration of certain emergency classes based on specific EALs. The effectiveness of sheltering in place versus evacuation for different types of events should be considered in establishing criteria.

Sheltering may be the appropriate protective action when:

- The dose or exposure will be less than that associated with evacuation;
- It places workers in a position where additional instructions can be rapidly disseminated;
- Rapid evacuation is impeded; and
- Plume arrival is imminent.

The degree of protection provided by buildings and structures within which workers would take shelter should be considered in facility plans and procedures. The shielding and air change rate provided by the structure are significant factors in determining whether sheltering alone will suffice as a protective action and how long sheltering should be used before evacuation is initiated in order to provide the lowest possible exposure to onsite personnel. Sheltering can provide substantial protection when the building has a low air change rate, the plume passage time is short, or the hazard produces its effects through direct contact exposures. Plans should include steps necessary to enhance the sheltering effects of structures that may be used for that purpose. For example, procedures should direct that doors and windows be closed, ventilation systems be secured, and personnel assemble in the most protected area(s).

Assembly areas, modes of transportation, evacuation routes, and reception centers should be identified in facility plans and procedures and should be clearly identifiable to users. Plans should also describe how evacuation instructions will be provided to onsite personnel and how they will move from personnel accountability areas to assembly (staging) areas for evacuation.

If private vehicles are to be used in evacuation, plans and procedures should make the operation as efficient as possible. Planning should include subjects such as: selecting vehicles with the largest passenger capacity, ensuring that all available passenger seats are filled, ensuring that each vehicle being used has sufficient fuel to complete the trip to the reception area, and organizing vehicles into groups of manageable size (generally not to exceed 20 vehicles in a group.) There should be plans to allow sufficient space between groups to allow other uses of evacuation routes.

Directionally separated facility egress points, assembly areas, evacuation routes and reception areas should be established to provide alternatives to routing evacuees through a plume. Egress routes should be clearly marked within and between facilities, as well as routes leading offsite. Procedures should contain guidelines for determining the optimum choice of egress and destination, as well as prepared, concise, oral announcements for use by emergency managers. Reception areas should be equipped to monitor evacuated personnel for contamination.

Evacuation plans should be closely coordinated with offsite transportation and law enforcement officials because those officials will be expected to establish controls over roads surrounding the facility/site. Such officials would also be the primary source of information on current road conditions created by inclement weather, range fires, earthquake damage, or traffic congestion.

2.4.2 Recommendations to Offsite Agencies

Emergency plans for DOE sites and facilities should provide for the health and safety of offsite personnel through coordinated planning and action with State and local government authorities. Facility and site plans should provide for timely notification with recommendations to state, tribal, or local authorities regarding protective actions for the general public.

- The recommendations should be made to the designated, responsible authorities as soon as possible, but within 15 minutes of recognition that a protective action criterion has been or will be exceeded, *or* that a General Emergency has been declared. Default criteria based on facility conditions should be prepared so that protective action recommendations to offsite authorities can be made in a timely manner, even though consequence projections have not been completed.

- The recommendation may be considered delivered when the content of the message is received and acknowledged by the emergency operations center, communications center, or central warning point(s) serving the offsite agencies.

- Each notification message to offsite authorities concerning the declaration of an emergency or change in emergency condition should restate the protective actions being recommended, even if the recommendation is "no protective action."

The protective action recommendations to offsite authorities should be formulated using the same types of criteria developed for decisions on evacuation or sheltering of site workers. The following information should be provided to offsite authorities for their consideration in implementing the facility's recommendations.

- The time available for carrying out the protective action before the onset of the impact (i.e., plume arrival).

- The specific areas within which protective action criteria may be exceeded, as calculated from the quantity of material released, the event type, and the meteorological conditions, or as determined from environmental sampling and monitoring results.

- The relative effectiveness of the different possible protective actions, considering the material and the release type. For example, sheltering in place may be as effective as evacuation for a short-duration gaseous release. For acutely toxic materials in high concentration, sheltering may be the only practical alternative unless evacuation can be completed before plume arrival.

- If state and local authority guidelines differ from the facility's PAC, the facility should also provide offsite authorities with the equivalent information related to the state/local guidelines.

2.4.3 Other Protective Actions

Other possible protective actions (e.g., in addition to sheltering and evacuation) have been identified by the WHO, the ICRP, and the IAEA. Some of these may be useful in certain circumstances and should be considered in developing onsite response plans. Others will be primarily, or exclusively, the concern of offsite authorities but are discussed briefly here as background for DOE and contractor personnel who will carry on a planning dialogue with those responsible for offsite protective actions. DOE and contractors should coordinate with responsible offsite agencies to plan for the recommendation and implementation of these protective actions for the facility and hazards of concern.

- **Ad Hoc Respiratory Protection.** Ad hoc respiratory protection is a cost-effective action that can significantly reduce inhalation of some hazardous materials by both workers and the general public. Ad hoc respiratory protection is especially useful in rapidly-occurring events. Effective protection against the inhalation of particulates and some gases can be provided through the use of readily-available materials such as handkerchiefs, towels, and cloth. Wetting a cloth can increase its efficiency as a breathing filter for some materials.

- **Control of Access.** Control of personnel access to affected areas can prevent unnecessary exposures and minimize the spread of contamination. It also minimizes interference with emergency response activities. Access control is most effective when implemented immediately upon recognizing that an area has been, or will be, affected by a hazardous material release.

- **Shielding.** Protection from radiation can be provided by an attenuating material between the source and potentially exposed people. The shielding provided by a structure is one factor that determines whether people can be effectively sheltered in that structure. For most radioactive releases, the ability of a structure to limit infiltration of outside air, thereby reducing inhalation exposure, is far more important than the shielding it can provide and will largely determine its suitability for sheltering personnel.

- **Radioprotective Prophylaxis.** To be effective, iodine prophylaxis requires both considerable planning and warning of the potential exposure. For greatest effectiveness, the stable iodine should be taken before or shortly after exposure. Because reliable radiological measurement information may be lacking during the initial stages of an event, the decision to administer stable iodine should be based on planned estimates of exposures and risk. The selection of the use of stable iodine as a protective action must be based on a careful evaluation of net benefit. Problems with administering stable iodine include identifying the affected population, distribution, and adverse health affects on a small percentage of the population. Other prophylactic measures include the administration of chelating agents or diuretics to speed the removal of specific radionuclides from the bodies of exposed individuals.

- **Control of Foodstuffs and Water.** An event with offsite environmental consequences may require implementing controls on the distribution of contaminated food and water. Although implementation of these actions offsite will be the responsibility of state and Federal health officials, DOE and its contractors may need to assist those agencies in developing intervention levels for specific hazardous materials and also manage onsite potable water supplies. Banning the sale of and preventing the consumption of contaminated foodstuffs imposes minimal risk but may have significant costs. Selection of protective actions for control of foodstuffs and water may initially be based on the predicted or measured ground deposition. At later stages, measurement of the concentrations of hazardous materials in foodstuffs and water should be available to refine decisions. Contamination of water supplies as a result of an airborne release is not likely to be a source of significant exposure. However, special consideration should be given to people who may consume rainwater or untreated water supplies. Long-term control of foodstuffs and water requires consideration of several factors. These include the availability, quality, and cost of alternative food sources; costs and resources associated with monitoring, control, and disposal; and rate at which the hazardous material is introduced to the foodstuffs.

- **Relocation.** Relocation of individuals can be implemented when emergency response is terminated. Relocation can be an extension of an evacuation, or it can be initiated in the later stages to facilitate decontamination efforts. The duration of the relocation depends on the natural and remediation activities eliminating the hazard. Procedures to determine the advantages and disadvantages of relocation and its net benefit are different from those of evacuation. The costs and impact of relocation will depend upon the number of individuals affected and the social and economic disruption created.

- **Decontamination of Land and Equipment.** Decontamination of land and equipment can prevent the spread of contamination and reduce or eliminate exposures. The projected dose to decontamination workers should be weighed against the dose to the public that will be averted. Decontamination efforts will generate large volumes of waste requiring disposal. While decontamination of small areas may be practical and cost effective, decontamination of large areas may be very difficult and costly. Detailed planning for decontamination is conducted during the recovery phase of response.

- **Changes in Livestock and Agricultural Practices.** The contamination of pastures and agricultural areas due to the deposition of released materials can require specific protective actions to minimize introduction of the contamination into the human food chain. Actions could include putting livestock on stored feed, delaying slaughter of animals until the hazardous material has been removed from their systems, and treating the soil with fertilizers to minimize the uptake of the hazardous material into foodstuffs. The use of severely contaminated land for agricultural purposes may have to be prohibited.
- **Medical Care.** Several regulatory requirements and directives state criteria for medical support that must be in place for workers, including those with radiological and/or hazardous material contamination. Planning for and identifying resources to provide fundamental medical care for members of the general public in the event of an accident should be carried out as part of the protective actions element. When

evaluating the selection of medical care as a protective action, consideration should be given to the treatment and documentation of injuries and illness and to reducing patient anxiety by explaining the potential benefits of treatment. Additional guidance on this subject is found in Volume IV, Chapter 3.

2.5 Protective Action Response

2.5.1 Accountability

Regulations, such as 29 CFR 1910.38, require employee emergency action plans, including "procedures to account for all employees after emergency evacuation has been completed." All DOE facilities are subject to this basic workplace safety requirement, which is generally considered to be met if designated persons (e.g., zone wardens) verify that no one remains inside an evacuated building and all evacuees meet at staging areas outside the building for an informal head count. The Order states that provisions be in place to account for employees after emergency evacuation has been completed. Each facility should establish a goal for the amount of time required to do this consistent with the facility hazards. A time-frame of 30 to 45 minutes is an accepted industry practice. To satisfy the intent of the Order requirement for accountability, facility emergency response staff should be able to identify any missing persons <u>or</u> establish that no persons in the facility are in need of assistance or rescue within 30 to 45 minutes from the recognition and classification of an emergency. Accountability of response workers should be maintained, once established.

The objective of accountability procedures is to ensure that search, rescue, and assistance efforts can be initiated promptly to help provide for the safety of facility personnel who may be injured, trapped, or unaware of the emergency condition.

Whether all facility personnel have or have not been accounted for should be a major consideration in an incident commander's "sizing up" a situation (National Fire Protection Association Standard 1021, Section 2-10) and one basis for the decision to risk the lives of rescue personnel in a hostile environment to search for victims. In keeping with the principles of protective action, risk to search and rescue personnel should be weighed against risk to missing workers. Positive accounting of facility personnel helps minimize risk to search and rescue personnel.

In high hazard areas, a positive control system, such as a log or badge/card reader that records the entry and exit of employees, should be considered. Where the potential for exposure to high levels of hazardous materials is low, such as in an office building, a less formal accountability system may suffice. A procedure whereby designated individuals search each work area upon evacuation to ensure that no persons remain should be sufficient for such low-hazard areas.

A goal of 30 minutes for full accountability should be met in areas where workers might be subject to risk of death or serious injury and where search and rescue operations might pose a significant risk to emergency personnel. Use of a positive control system can help achieve this goal. Specific examples of facilities where a positive control system should be applied are (1) where the nature of the facility operation is such that people might become quickly trapped or incapacitated by the event so they cannot take action to protect themselves (explosions, rapid release of incapacitating materials, nuclear criticality) or (2) where there is substantial risk of personnel being out of communication and thereby unaware of the hazard and the need to evacuate (remote areas with poor alarm/public address coverage, high-noise areas).

A short duration accountability time standard, or a positive accountability system, need not necessarily be applied to an entire "facility" but may be applied to that part of a facility or complex that contains the hazard.

2.5.2 Protection of Response Personnel During Reentry Activities

Planning and actual conduct of reentry activities must consider that each emergency event is unique. Therefore, the response structure for conducting reentry activities must be flexible and capable of responding to a wide range of conditions.

Reentry Decision-Making

Reentry activities will often involve high risk, time-urgent actions. ERO management may be called upon to make rapid risk versus benefit type decisions and then to establish priorities for selected activities. Therefore, it is important that emergency plans and accompanying implementing procedures provide the necessary structure and guidance:

- The emergency plan should identify the position within the ERO with the authority and responsibility to authorize reentry activities and approve doses/exposures that may exceed occupational or administrative limits.
- The implementation of selected reentry activities should be carried out by elements of the ERO closely associated with the facility, located at the event scene or affected area.

- To assist with the decision-making process, training and procedures should address the following:

    - Criteria and guidance to assist in prioritizing reentry activities should be provided. Consideration should be given to the benefit achieved as well as the availability of qualified personnel and resources to carry out any given activity.

Information and requests regarding reentry activities should be forwarded to the ERO position having decision-making authority. A means to record and indicate the priority of proposed activities and track progress on authorized activities should be provided.

- Criteria and guidance to assist in making risk versus benefit determinations should be provided. Consideration should be given to protecting the health and safety of workers and the general public, minimizing damage to the facility, and limiting environmental impact or damage. A means for estimating exposure to hazardous material during the reentry activity should be provided. The possibility that the reentry activity could cause a release or worsen an existing release of hazardous material should be considered. Means to estimate consequences of a potential release on workers, the public, and the environment resulting from reentry activity should be provided.

- Criteria and guidance to assist in making decisions concerning the authorization of emergency dose or exposure should be provided.

- A mechanism for coordinating reentry activities within the site ERO and with state, local and other Federal agencies as necessary should be provided. As a minimum, information regarding reentry activities planned and in progress should be provided to these agencies. Priority should be given to communication of any pertinent information acquired during reentry activities (e.g., source term information, release duration, facility status.)

Reentry Operations

Once the decision has been made to perform a reentry activity, planning for the reentry activity should be performed by personnel responsible for managing the on-scene response. They should have direct access to the most current information, be familiar with the facility or event area, and have knowledge of the personnel and resource requirements of the task. One position at the facility or incident scene level should be vested with the responsibility to coordinate the reentry planning process. Responsibilities of this position might include identification of personnel and equipment needs, determination of personnel protection requirements, assignment of personnel to reentry teams, job planning, team briefing/training, monitoring progress of activities, de-briefing teams, and collecting data upon completion. During both planning and preparation, this position may require the support of several other disciplines such as: health physics, industrial hygiene, industrial safety, facility operations, engineering, medical, security, and others.

The following items should be considered when planning reentry activities and preparing reentry teams:

- Provide procedures and/or checklists to ensure that all factors are considered prior to dispatching reentry teams. Reentry planning should use the most current status information; provisions should exist for modifications as new information is received. Each team should receive a briefing prior to dispatch that covers all safety and job specific aspects of their assignments.

- Reentry planning should make use of all available information regarding interior configurations, locations of hazards, etc. Pre-fire plans are particularly well suited for use in such planning.

- Reentry preparation should include contingency planning to ensure the safety of reentry personnel, such as planning for the rescue of reentry teams.

- Provide guidance on selection of reentry team members. Teams should consist of the minimum number required to perform the job but should not be less than two persons. Team members should be chosen based upon job qualification, training, proficiency in use of protective equipment, and exposure history (radiological) or sensitivity to toxic material. For very high risk tasks, volunteers should be used. Criteria should be developed to determine what constitutes a "high risk" task and how to select the most appropriate volunteer for a given task. Criteria for selection of volunteers may differ for radiological versus toxic material events. If feasible, volunteers should be evaluated with respect to age, health, and previous exposure history (for radiation exposure). Each volunteer should be advised of the known or anticipated hazards prior to participation.

- Provide personnel performing reentry planning with training and guidance on the selection of appropriate protective clothing and equipment. Identify ERO positions (or other personnel) with the technical expertise and the responsibility to determine what protective equipment and clothing is appropriate for the situation at hand.

- Under some circumstances, the control of contamination may be a concern. Reentry planning should address methods for reducing the spread of contamination and ensuring that reentry activities do not inadvertently increase the actual or potential release of hazardous material.

- Ensure that adequate job planning is performed prior to team dispatch. Even the simplest jobs may become much more complex under accident conditions. Thorough team preparation for the job is critical for the safety of the team members and the success of the task. Make sure that each team understands the job to be performed and that each team member understands their role. Some job preparation items to be considered include procedures, checklists, parts, tools, test equipment, use of "dry-run" or mock-up training, and appropriate monitoring equipment (health physics and/or industrial hygiene).

- Each reentry team should be provided with a primary and back-up means of communication. Prompt reliable communications are necessary to notify teams of changing conditions, monitor job progress, provide additional instructions, and contact with those responsible for reentry control activities.

- Immediately upon return from completing a reentry assignment, teams should be de-briefed. The de-briefing should be designed to collect information relating to the job performed, facility status, conditions encountered, and exposure received. Information should be recorded and passed on to appropriate ERO positions.

- Provide access to records and documents necessary for reentry planning. Training, job qualification, and dosimetry records may be necessary for team selection and assignment. Engineering drawings, procedures, and technical references may be necessary for job planning.

Reentry for "Rescue and recovery"

This section provides guidance for determining appropriate actions for the rescue and recovery of persons and the protection of health and property during emergency response. 10 CFR 835.1302 contains requirements to be met when conducting these operations in response to a radiological hazard. The regulation provides dose guidelines for the control of exposure during specific types of activity. Although the regulation is designed for response to radioactive releases, the basic principles apply to any type of hazardous material response. The regulation begins with three basic principles: "1) The risk of injury to those individuals involved in rescue and recovery operations shall be minimized, 2) Operating management shall weigh actual and potential risks to rescue and recovery individuals against the benefits to be gained, and 3) Rescue action that might involve substantial risk shall be performed by volunteers."

General Considerations. The risk of injury to persons involved in rescue and recovery activities should be minimized, to the extent practical. Control of exposures should be consistent with the immediate objectives of saving human life; recovering deceased victims; and/or protection of health, property, and the environment.

- Personnel managing response activities should exercise judgement to evaluate any proposed action involving exposure. Evaluation should consider risk versus benefit, e.g., weighing the risks of health impacts, actual or potential, against the benefits (i.e., social, economic, etc.)

- Decisions governing rescue and recovery activities often have to be made on a time urgent basis. Emergency Planners should develop guidance and a methodology to assist decision makers in rapidly evaluating risk versus benefit. Guidance should also recognize that accident situations involving the saving of human lives will require different evaluation bases than those required to recover deceased victims or to protect property.

- Before dispatching any reentry teams, the Emergency Manager or the Incident Commander should ensure that the activities have been coordinated with the head of the organization providing the reentry team members (e.g., if the fire department is providing the reentry personnel, the Emergency Manager/Incident Commander will coordinate with the responsible fire department officer on the scene.) This discussion should ensure that all operational and safety concerns are resolved prior to team dispatch.

- For controlling exposures to radiological hazards, the EPA has prepared guidance and criteria which is presented in *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*. EPA limits for workers performing emergency services apply only to doses incurred during an emergency. Per 10 CFR 835.202(a), exposures received in emergency exposure situations are not included in meeting the occupational exposure limits to general employees resulting from DOE activities. The EPA Manual also provides tables with general information that may be useful in advising workers of risks of acute and delayed health affects associated with large doses of radiation.

- Due to the uncertainties, the general approach taken by hazardous material responders has been to only perform entries while using the maximum protective equipment for the most severe hazards present. For extraordinary circumstances (e.g., life saving activities, protection of large populations) guidance and criteria should be provided for determining the minimum acceptable level of worker protection. Guidance and criteria should be consistent with that governing hazardous material response for private industry. Guidance, criteria, and technical information concerning response to hazardous materials have been published by a number of organizations and Federal agencies including the Occupational Health and Safety Administration (OSHA), EPA, the Department of Transportation (DOT), the Federal

Emergency Management Agency (FEMA), National Fire Protection Association (NFPA), AIHA, and others.

Emergency Situations. This section presents dose criteria and judgement factors for three types of emergency action: saving of human life; recovery of deceased victims; and protection of health and property. 10 CFR 835.1302 contains requirements for emergency exposure during rescue and recovery activities.

- **Saving of Human Life or Protection of Large Populations**. If the victim is considered to be alive, the course of action should be determined by the individual in charge of the on scene response activity. The potential amount of exposure to rescue personnel should be evaluated, and an exposure objective should be established for the rescue mission. The evaluation of the inherent risks should consider:

  - The reliability of the prediction of injury from measured/estimated exposure rates. In this context, consideration should be given to the uncertainties associated with the specific instruments and techniques used to estimate the exposure rate. This is especially crucial for exposure to radiation when the estimated dose approximates 100 rad (1 gray) or more.

  - The effects of acute external and/or internal exposure.

  - The capability to reduce risk through physical mechanisms such as the use of protective equipment, remote manipulation equipment, or similar means.

  - The progress of any mitigative efforts that would decrease or increase risk.

  - The probability of success of the rescue action.

- **Recovery of Deceased Victims**. The recovery of deceased victims should be well planned. Except as provided below, the amount of exposure received by persons in recovery operations should be controlled within existing occupational exposure limits.

  - When fatalities are located in inaccessible areas due to high risk, and when the recovery mission would result in exposure in excess of occupational exposure limits, special remote recovery devices should be considered for use in retrieving bodies.

  - When it is not feasible to recover bodies without personnel entering the area, the official in charge may approve personnel to exceed occupational exposure limits. This approval, for an individual, should not exceed 10 rem ((0.1 sievert) in any year.

- **<u>Protection of Health and Property</u>**. When the risk (probability and magnitude) of the hazard either bears significantly on the state of health of people or may result in loss of property so that immediate remedial action is needed, the following criteria should be considered:

  - When it is deemed essential to reduce a potential hazard to protect health or prevent a substantial loss of property, a planned exposure objective for volunteers should be established not to exceed 10 rem (0.1 sievert) for an individual in a year. Under special circumstances, an exposure objective for volunteers not to exceed 25 rem (0.25 sievert) in any one year may be set.

  - When the risk of exposure following the incident is such that life might be in jeopardy, or there might be severe effects on health or the public or loss of property inimical to the public safety, the criteria for saving of human life should apply.

2.5.3 Management of Personnel Exposures

Careful management of personnel exposures and appropriate follow-up can minimize the risk of adverse health effects. If possible, exposures should be maintained within existing occupational (or administrative) exposure limits.

Procedures should establish methods of controlling access to areas where hazardous material contamination might be encountered. The responsibility for controlling access to and activities within such areas should be assigned by the ERO.

Methods should be established for assigning personnel to tasks within the controlled area and managing their exposures, to include: defining the physical, training, and other required personnel qualifications; conducting briefings or specialized instruction on the task to be done and hazards to be encountered; determining allowable exposures and establishing limits on exposure or stay time; issuing appropriate protective clothing and equipment; providing devices or instruments with which to monitor exposures to the hazard; recording the movement of personnel in and out of the controlled area and the exposure, dose, or level of contamination encountered; recording and tracking accumulated emergency exposure; and, if necessary, decontaminating personnel after they exit the controlled area.

Records of emergency worker exposure to hazardous materials should be maintained during and following emergency events. Applicable requirements for maintaining hazardous material exposure records are found in 29 CFR 1910.1020. Requirements for medical programs are found in DOE 440.1 and in 29 CFR 1910.120.

Additional criteria, such as the following, should be considered in delineating responsibility for reentry actions:

- Guidance and criteria for controlling exposures to workers should be developed and presented in procedures to assist in decision-making. Guidance should be provided to assist in determining what activities warrant consideration of exceeding normal exposure limits. Criteria should be developed that establish exposure bounds for specific types of activities.
- A policy governing the use of prophylactic drugs for dose reduction purposes should be created. Specific guidance on implementing that policy should be incorporated in procedures.
- The risks from entering an environment containing unknown quantities of chemical toxins is very different than the risk stemming from exposure to radiological material. The availability of installed instrumentation or portable monitoring equipment capable of detecting levels of toxic chemicals that could cause severe health effects or death may be limited. The lack of instrumentation, coupled with the uncertainty of projecting transport in a facility or the environment, makes it very difficult or impossible to accurately calculate estimated exposures to reentry personnel that represent an acceptable risk.
- Although the concept of "As Low As Reasonability Achievable" (ALARA) was created as a general goal for reducing normal occupational exposure to radiation, it is also a useful guide for controlling emergency exposures to hazardous materials during emergency response.

2.5.4 Decontamination

Personnel, vehicles, and equipment evacuated from the area affected by a hazardous material release may be contaminated. Decontamination can reduce the health hazard to the evacuees themselves and to others who might later come in contact with contaminated people or articles.

Facility plans and procedures should provide for monitoring of personnel, vehicles, and equipment leaving areas potentially affected by a hazardous material release. If possible, monitoring should be done before the personnel or equipment leave the DOE site. Personnel and vehicles found to be contaminated should be directed to predetermined decontamination stations and decontaminated to established levels prior to release. Decontamination stations should be stocked with adequate supplies, equipment, and procedures to support all decontamination activities. Intervention criteria should be included in procedures. Antidotes and MSDSs should be available. Provisions should be made for collecting, documenting, transporting, and analyzing all samples, including biological samples.

For personnel who have been severely injured, medical treatment should take priority over decontamination. Procedures should also address the monitoring and decontamination of vehicles used to transport injured and contaminated victims. Memoranda of understanding with local hospitals and ambulance services should address transport, receipt, and treatment of contaminated victims and decontamination of equipment, facilities, and the disposal of wastes.

Procedures should address methods used to limit the spread of contamination from the victim to their surroundings during transportation to pre-designated facilities for treatment and later decontamination of injured personnel. (Also see Volume IV, Chapter 3)

Decontamination should occur in existing facilities, if possible. If decontamination facilities of the appropriate type do not exist on the site, or if existing decontamination facilities would not have the necessary capacity or would be made unusable as a result of the emergency, procedures should identify alternate methods or provide for establishing temporary facilities. Decontamination methods to be employed will depend on the types of contamination and the type of work activities performed during the response.

Monitoring of individuals and equipment should be performed at appropriate stages during decontamination to ensure that decontamination has been successful.

Decontamination plans and procedures should provide for containment and disposal of contaminated wash and rinse solutions and contaminated articles in compliance with state and Federal regulations.

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3. EMERGENCY MEDICAL SUPPORT

3.1 Introduction

Coordination is critical between the planners responsible for the medical emergency plan and the emergency planners responsible for the comprehensive Emergency Management Program. Each group has information and skills essential to the success of the other group. The plans should be developed and reviewed in concert to ensure an integrated approach.

Since few, if any, DOE sites maintain the full range of medical capabilities available in the surrounding community, injured employees will be transferred to offsite facilities when the medical condition allows. The surrounding community may also provide capabilities and resources that reinforce onsite capabilities. A close working relationship is necessary to ensure that medical support is provided seamlessly during an emergency.

By using the results of the Hazards Survey and/or Hazards Assessment, medical and emergency planners should be able to develop a tailored system to protect the health and safety of DOE workers and the public. The availability of medical capabilities and resources within the surrounding community should be closely examined. There will likely be situations where the probability of a particular service or resource being needed, combined with the confidence the service or resource is available in the surrounding community, indicate that it is more cost effective to develop agreements to use the offsite capabilities rather then develop a redundant capability at the DOE facility. There are other situations where DOE facilities will have unique expertise that is not readily available within the surrounding community. This Guide encourages using the most effective approaches to meeting DOE O 151.1 requirements.

Base Program. DOE O 440.1 is the replacement directive for DOE 5480.8A. DOE O 440.1 establishes requirements for facility and site medical programs within Section 18 of the contractor requirements document. Most medical situations will fall within the scope of the program established to meet these requirements. The *Accreditation Manual* of the Joint Commission on Accreditation of Healthcare Organizations, Federal Ambulance Specifications, 29 CFR 1910.151, and NFPA 99 will likely be used, in addition to DOE O 440.1, to define facility/site medical programs.

DOE O 440.1 Contractor Requirements Document, Section 18.h., directs the physician responsible for providing medical services to develop the medical portion of the "site emergency and disaster plan." DOE O 151.1 defined the interface between the medical plan and the emergency plan as situations with mass casualties. Mass casualty situations were chosen as the interface point because they are characterized by the marshaling of resources from a variety of sources. In order to ensure the health and safety of the injured, these actions must be well planned, practiced, and controlled. The base program provides the framework to coordinate planning, preparedness, and response actions.

Section 3.2 discusses the characteristics of mass casualty incidents and identifies areas that should be addressed by medical and emergency planners, working in concert.

3.2 Mass Casualty Incidents

3.2.1 Definitions

There are definitions, such as those contained in the Brady *Paramedic Emergency Care* text, that define the severity of a mass casualty incident. The following definition (drawn from Butman) is not meant to replace those definitions. Instead, it is to help personnel identify mass casualty incidents.

The difference between a mutual aid response and a mass casualty incident will depend on factors that are subjective and highly specific to each DOE facility and its surrounding community.

A **mutual aid response** will normally be characterized by three conditions:

(1) Facility first responders and facility Emergency Medical Service personnel being able to mitigate life threatening injuries in all victims to the same level that they would be able to mitigate similar injuries in a single victim;

AND

(2) Within 10 to 20 minutes, enough other responders and ambulances can be at the site to provide normal levels of care and transportation;

AND

(3) The hospitals that can be reached within the normally accepted time for transport of patients can provide adequate stabilization until definitive care can be provided.

In general, the quantity of personnel and resources *ultimately* available is insufficient in a mass casualty situation. Only those personnel and resources that are available within the time allowed by standard medical treatment protocols are of value. Plans that enlarge the pool of available personnel and resources are not sufficient if there are time problems and the triage principle must be employed.

Therefore, a **mass casualty incident** exists when:

(1) The number of patients and the nature of their injuries make the normal level of stabilization and care unachievable;

AND/OR

(2) The number of Emergency Medical Service personnel that can be brought to the site within the time allowed is not enough;

AND/OR

(3) The stabilization capabilities of the hospitals that can be reached within the time allowed are insufficient to handle all the patients.

3.2.2 Initial Phase

By definition, the initial phase of a mass casualty incident will have more patients than available facilities or personnel can properly treat. Planning for such instances shall be coordinated with offsite authorities; DOE O 440.1 requires that the medical plan be compatible with the offsite plan. Site planning should be well-coordinated with offsite emergency management organizations as well, since offsite emergency organizations could be activated to assist the site or because of the large geographic impact of a natural phenomena event. Capabilities, resources, and activation procedures should be worked out in advance. The goal should be to have considered likely scenarios and developed decision aids to simplify the process of getting the injured to medical treatment facilities in the most expeditious manner.

At many DOE sites, security is a paramount concern. While these are valid concerns, they can sometimes impact the rapid provision of emergency medical services. Rapid treatment is especially critical in trauma or cardiac situations. Sites should evaluate security systems and develop emergency ingress/egress procedures to allow for rapid access of emergency medical responders, their vehicles, and equipment to critically injured or ill patients. Emergency ingress and egress procedures should also consider how best to use offsite responders, while accommodating security concerns.

Communications equipment should be compatible with offsite agency frequencies. There should be at least one joint user/mutual aid frequency available on all communications equipment to simplify inter-agency communications. Should the state have a designated emergency medical service frequency, that frequency should be included on site emergency medical service radios.

Since mass casualty incidents are likely to require the coordinate efforts of several agencies, there should be an established mechanism for identifying patients and recording the medical facility to which the patient has been transported.

Mass casualty situations and emergencies involving casualties may involve situations where teams must reenter dangerous environments to evacuate casualties. Rescue teams are formed by a variety of organizations for these purposes. The primary responsibilities of rescue teams are: provide immediate life saving aid during day-to-day operations; remove victims from dangerous scenes (e.g., fires, accidents) or contaminated areas; remove gross contamination, if present and possible; and transfer the victim to medical personnel.

Rescue Team size, staffing, and training should be based on the potential threats outlined in the Hazards Survey. Rescue Teams can be composed of personnel with a range of backgrounds but should have at least one medically trained individual (i.e. First Responder, Emergency Medical Technician, etc.) per team. Rescue Teams should receive any specialized training necessary for the potential threats. This training may consist of, but is not limited to hazardous materials (HAZMAT), confined space rescue, and high angle rescue. If the facility chooses to use offsite rescue teams, the facility must ensure that the offsite teams are trained in the peculiar hazards at the facility. Also see Volume IV, Chapter 2.

Site emergency medical service personnel are normally found in the site's fire department or occupational medicine department. In some cases, the security or protective force department also has emergency medical service personnel. Regardless of how the organization is structured, the site Medical Director should specify minimum standards for training and equipment for all emergency medical personnel. Site standards for training and equipment should be compatible with similar offsite standards, if not the same as offsite standards.

3.2.3 Follow-On Activities

After casualties have been evacuated from the incident scene, other activities and services may need to be activated before the emergency is terminated. These activities and services should not require the same level of pre-planning as characterizes planning for the initial phase of a mass casualty incident. The emergency plan should identify how necessary services and capabilities can be accessed.

There could be fatalities; some possible scenarios could result in mass fatalities. Planning should consider legal requirements for handling of remains, as well as identify mortuary capabilities to handle to large numbers of fatalities. A massive structural collapse could result in requirements for urban search and rescue that exceed the capabilities of facility rescue teams. Many scenarios could result in requirements for critical incident stress management services for the emergency responders themselves. There are national programs that provide assistance in all these areas; there could be regional, state, or local programs, as well. Consideration should be given to accessing these established capabilities, if it is more cost effective.

3.3 Hazardous Material Program

The Hazards Assessment that must be developed for those facilities subject to the requirements of Chapter IV, DOE O 151.1, will provide further details on the potential scenarios and numbers of contaminated, injured workers at the facility. This information is critical to ensure that adequate facilities and equipment are available to provide medical care to the injured workers, while minimizing the impact of the contamination.

3.3.1 Offsite Interface

Contaminated, Injured Personnel. An important consideration is the offsite emergency medical service and local medical facility's ability to handle contaminated patients. Procedures and decision criteria for transport and treatment of contaminated, injured patients should be developed in advance, with consideration given to the capabilities of all organizations, as well as the legal and financial implications of various options. Procedures should, at a minimum, address contaminated patient transportation; equipment use and disposition; contamination control; and decontamination of patients, equipment, and facilities.

Radiological Emergency Assistance Center/Training Site (REAC/TS). REAC/TS provides treatment consultation services on a 24-hour basis as part of the Federal Radiological Assistance Program and serves as the primary source of medical expertise for DOE site-related injuries, as well as support to offsite agencies. (Also see Volume VIII.)

REAC/TS has a number of courses to prepare medical personnel to cope with contaminated patients in both the pre-hospital setting or clinical facility. Other industrial and academic sources throughout the country provide training and information for coping with these patients. DOE emergency medical personnel should contact these institutions for additional information. Also, NCRP Report #65 provides information on contaminated patient care.

3.3.2 Facilities

Decontamination centers for treating radiologically or chemically contaminated individuals, detecting and minimizing the spread of contamination, and decontaminating medical equipment (e.g., ambulances, defibrillators, cots) should be established as part of the medical facility or as a stand-alone facility. As a minimum, they should include the following elements.

- A designated contaminated patient entrance and procedures to restrict spread of contamination.
- An area equipped for removing and disposing of readily transferable contamination.
- Showers for contaminated patients, including means by which to control and collect contaminated water or materials.
- Radiation survey instruments and decontamination supplies.
- Showers and change rooms for medical and health protection personnel, including means by which to control and collect contaminated water or materials; dedicated ventilation system.
- If applicable, capability to perform chelation therapy treatment for patients with transuranic contamination.
- Antidotes and/or chemical burn treatments, as appropriate, for hazardous material contaminated patients.
- Record keeping materials for recording treatment and extent of contamination and exposure.

(Also see the Volume IV, Chapter 5.)

3.3.3 Equipment

Medical personnel are responsible for assessing patient condition, providing necessary emergency medical care, and determining needs for further medical care. Equipment needs should be based on the Hazards Survey, Hazards Assessment, and the appropriate Standard of Care. NFPA Standards 1991, 1992, and 1993 provide information on HAZMAT clothing and equipment that emergency medical service personnel may need if they are members of site HAZMAT teams or participate in HAZMAT operations. NFPA Standard 1999 provides information on emergency medical service protective clothing. (Also see the Volume IV, Chapter 5.)

Radiation/Health Protection and Industrial Hygiene personnel assist medical personnel and should have the necessary equipment for surveying patients, providing decontamination advice, assisting in contamination and exposure control, and assisting medical personnel in accomplishing urine analysis, fecal analysis, in-vivo counting, and radiochemical analysis for contaminated patients.

3.3.4 Services

Procedures for handling and disposing of contaminated remains should be developed and coordinated with local medical facilities, medical examiner's offices, and funeral directors. Some considerations are decontamination procedures; monitoring, packaging, and transporting the remains; and documentation of the actions taken.

The National Foundation for Mortuary Care and Department of Defense publications and personnel may be available to provide advice and assistance in this area.

3.3.5 Preparedness Activities

OSHA Regulations (29 CFR 1910.120) require that personnel who may be exposed to hazardous materials during an emergency response receive specialized training. DOE site emergency medical directors have an obligation to ensure that offsite emergency medical service personnel who may respond to assist at a DOE site have received the necessary training prior to being placed in a situation that could expose them to hazardous materials. Additionally, offsite emergency medical service responders should be provided with any necessary specialized training unique to a DOE site response. Refer to NFPA 473, Volume V, Chapter 4; Volume X, HAZWOPER Emergency Response; and Volume III, Chapter 2 for additional information.

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4. EMERGENCY PUBLIC INFORMATION

4.1 Introduction

The ability to provide the public, media and DOE employees with accurate and timely information is based on an effective Emergency Public Information (EPI) program. To be effective, emergency public information should be coordinated with onsite and offsite Federal, state, local and tribal Emergency Response Organizations (ERO). The EPI program provides the means for a facility to coordinate the timely exchange of information among representatives from DOE and other organizations. This coordination is critical to prevent dissemination of confusing, conflicting, and erroneous information.

Departmental and emergency response credibility is enhanced through an effective emergency public information program, which is based on a day-to-day public information operation that can be expanded for an emergency response. This capability to expand is developed in cooperation with onsite and offsite organizations through the detailed planning and coordination of plans, procedures, education, and training.

This chapter will identify the emergency response components of the EPI program and their roles during emergency response; emergency facilities necessary to support response; establishment of media interfaces; development and release of emergency information; development of EPI training, drills, and exercises to including offsite organizations; development of an emergency public education program; and organization of a Joint Information Center (JIC) with representatives of offsite agencies.

Base Program. EPI requirements are focused in Chapter IX of DOE O 151.1. This chapter applies to Base Program facilities/sites, since all emergencies will require some EPI response. The extent of the EPI program and organization for Base Program facilities/sites depends on the types of Operational Emergencies identified and the potential consequences. The detailed structure of EPI described in this chapter is appropriate for Hazardous Material Programs or Base Programs which potentially affect more than the facility/site itself (e.g., a substantial oil spill), but is useful as general guidance for other Base Program facilities and sites.

4.2 EPI Organization

Operations/Field Offices and sites/facilities are responsible for developing and implementing EPI Plans and organizations. The EPI Plan should specify roles and identify individuals within the EPI organization by position and responsibility. EPI activities and the number of EPI staff required to respond effectively to an emergency will vary with the nature, severity, duration, and public and media perception of the emergency. For example, while full notification and activation of the EPI organization would likely be required during a Site Area Emergency or General Emergency, only partial notification and activation may be required during an Alert. This section provides guidance for establishing an EPI response organization to meet the needs of the media, public, and employees during all emergency events.

The overall emergency response to and recovery from an Operational Emergency is directed and coordinated by the site emergency director. The Operations/Field Office public affairs director is responsible for DOE EPI activities during the response to and recovery from an emergency. The EPI organization supports and enhances the onsite and offsite emergency operations.

4.2.1 Initial EPI Organization

Prior to activation of the JIC, the following functions should be staffed, commensurate with the graded approach for the DOE Emergency Management System.

- A Public Affairs Director within the Emergency Operations Center (EOC) who reports to the Emergency Director and directs and coordinates EPI activities; who coordinates preparation and release of all EPI directly with the Emergency Director; and who communicates from the EOC directly to the facility established to disseminate emergency information.

- A Public Information Officer assigned to the EPI response team involved in an offsite response deployment to provide information regarding DOE roles and capabilities.

- A News Writer to develop news releases in coordination with the Public Affairs Director.

- An Authorized Derivative Classifier, on call for events that may have security implications, to review news releases for classified material.

- A Media Relations Coordinator to respond to media and public inquiries.

- An Employee Communications Coordinator to inform employees and respond to their inquiries; should also be assigned liaison responsibility to employee families.

- A Government Coordinator to ensure notifications and updates are provided to cognizant representatives of all local, state, tribal, and Federal government organizations.

4.2.2 Full EPI Organization (after activation of the JIC)

When the JIC is activated, the JIC management team, which includes the JIC Manager, News Manager, DOE spokesperson, and outside agency representatives, should be located where it can most effectively share and coordinate information. These position titles may vary slightly from site to site, but the functions of information coordination, production, dissemination, and monitoring and analysis of media coverage and public perceptions should be incorporated into the JIC organization. Internal and external organizational relationships should be depicted in the Emergency Plan. The primary responsibilities of each member of the EPI organization are identified as follows.

- **Public Affairs Director.** A DOE representative, usually located in the Operations Office EOC, who reports to the Emergency Director and directs and coordinates all EPI activities; coordinates preparation, approval, and release of all EPI; communicates with Public Affairs Liaison in DOE Headquarters EOC; communicates from the EOC directly with the JIC about ongoing emergency activities to identify which activities may require news releases and/or media briefings; and resolves issues and questions from the JIC Manager.

- **News Release Writer.** Works directly with the Public Affairs Director to gather confirmed information on the event and prepares news releases.

- **Joint Information Center Manager.** Responsible for overall management of the JIC, the timely release of clear and accurate information to the public and media; oversight of the JIC facility and JIC staff; and remains in direct communication with the Public Affairs Director. Ensures coordination with, and among, local, state, tribal, and Federal designated representatives at the JIC and other locations, and accommodates JIC administrative support needs.

- **Joint Information Center News Manager.** Accommodates the news media; coordinates news conferences; provides media kits and news releases to the media; and assists the JIC Manager in all matters pertaining to interaction with the media. Serves as an extension of the JIC Manager by tracking inquiries between the EOC and the JIC; keeping the Public and Media Inquiry Teams updated on emergency events; ensuring that the JIC Manager has adequate review of information prior to media briefings; ensuring that communications are maintained with the EOC; and remaining in direct communication with the JIC Manager.

- **Media Monitoring Team.** Monitors broadcast and print media coverage of the emergency; records broadcast coverage; retains copies of print media coverage; reviews all media coverage for inaccuracies and rumors; provides the JIC Manager with reports; and periodically, or upon request, provides to the JIC News Manager an updated analysis of issues, including perceptions of the public and media.

- **Media Inquiry Team.** Contacts the media upon activation of the JIC; ensures that approved news releases are provided to the media; updates the media not present at the JIC; receives and assimilates incoming data from media monitoring team and others; and responds to incoming telephone queries and requests. Reports to the JIC News Manager through a team leader. Information for response to media calls may be obtained from status boards, news releases, chronologies, fact sheets, supervisor's notes from news conferences, resource books, and other approved written materials.

- **Public Inquiry Team.** Answers inquiries from the general public with accurate, up-to-date information to prevent the spread of misinformation. Information for response to public calls may be obtained from status boards, news releases, chronologies, fact sheets, supervisor's notes from news conferences, resource books, and other approved written materials.

- **Joint Information Center Support Staff.** Provides administrative and logistical support and equipment needs including, but not limited to, outgoing services, such as distribution of all fax notifications on a designated fax list; accomplishment of incoming fax services, such as passing all incoming fax messages to the JIC Manager as soon as possible; reproducing news releases and distributing them to the JIC staff, media, and others in the JIC; and messenger services.

- **Offsite Agency Public Information Representatives (representatives of local governments, states, tribes, and Federal agencies).** Coordinate information to be released to the media; provide accurate, timely, and applicable information to the public about emergency operations within their jurisdictions; participate, as appropriate, in news conferences.

- **DOE Spokesperson.** Briefs the media and/or public on site response and recovery activities and event status. A technically skilled, senior-level DOE manager trained in crisis/risk communications, the spokesperson represents site management and must be a credible source of information. Usually is recognized as a spokesperson for DOE and contractor management.

- **Technical Spokesperson.** Interprets technical information to the media and public in lay terms, including pertinent information on radiological, chemical, other hazards, and operational implications of the incident, as needed. Technical support may be provided to the DOE spokesperson and other JIC staff.

- **Employee Communications Coordinator.** Informs employees of event status and emergency response and recovery activities in support of the Emergency Director. Responds to employee inquiries. May also make communications concerning special situations involving employee families.

- **Authorized Derivative Classifier.** On call for events that may have security implications. Reviews news releases for classified material.

4.2.3 Position Descriptions and Staffing

Position descriptions should describe the critical functions of each position and include checklists. A checklist should itemize the duties relevant to each emergency response position, beginning with notification and continuing with the tasks to be performed throughout an emergency until normal operations resume. At a minimum, each position should be staffed with a primary and one alternate. If possible, a third person should be assigned to serve as a second alternate.

4.2.4 Facility Description

The JIC must provide adequate space and equipment to accomplish the functions addressed in the previous section. Additionally, the JIC must provide for coordination of emergency information among onsite and offsite organizations.

JIC plans should provide work space for reporters and camera crews. This space could be an auditorium or other area within proximity of the JIC, where press conferences and associated media activities might be accomplished (i.e., phones, facsimile, work space, podiums, lighting, microphones, etc.). Requirements should be established on the basis of a media needs analysis.

The EPI Plan and site/facility emergency plan must specify the exact locations of the JIC by building name, street address, city, and state, as well as driving instructions from airport(s), major cities, and alternate routes. For Hazardous Material Operational Emergencies, an alternate JIC also should be included in areas where the primary JIC is inside the EPZ and the JIC may need to be evacuated.

The EPI and site/facility emergency plan should also address the following topics.

- **Physical Security.** Security is imperative in all aspects of an EPI Program. Security personnel should be on call to control access to the JIC by designated response personnel. Security should control access to the site by the media as required by procedure. Special cases of exception should be approved by the

Emergency Director or the designated representative. Procedures for badging should be provided.

- **JIC Identification/Media Sign-in.** Procedures for maintaining 24-hour points of contact for media and procedures for media arrival and sign-in to the JIC should be established.

- **Equipment and Supplies.** Equipment associated with the functions addressed above should be based on a media needs analysis, be readily accessible, and include items such as adequate phone lines for JIC staff; television, newspapers, and radios for media monitoring; computers and printers for news release preparation and chronology maintenance; facsimile machines and copiers; media kits or information pamphlets which include information on the site, plant, emergency procedures, and/or general schematics/photographs, visual aids for briefings to include maps, site plans, schematics, and EPZs; and Internet access information, as appropriate.

4.2.5 Training

Training is an essential part of a successful EPI Program and is required by DOE O 151.1. Specialized training is necessary for emergency responders to understand how to deal with the public, employees, and media. The following concepts should be used while developing an EPI training program.

- All EPI Program team members should receive initial training prior to participation in an event, drill, or exercise. Training should include an overview of EPI emergency preparedness and response; DOE policy on emergency management, site plans, and procedures; site/facility operation; hazardous materials risks; and facility-specific orientation training. Position-specific training should include cross-training.

- Each team member should receive comprehensive, annual requalification training in their respective functions, as well as in the concept of operations of the entire EPI Organization and its relationship to the whole site emergency response effort. This requalification training should include a:

  - summary of “key topics” covered in the initial training;

  - demonstration of functional capabilities through tabletops, stop-action drills, and other related activities; and

  - detailed review of findings and lessons learned from exercises.

- JIC operations training should be made available for appropriate DOE personnel, offsite emergency management representatives, government officials, state emergency management personnel, county commissioners, tribal representatives, and county health officials.

4.2.6 Drills and Exercises

Exercises are valuable to evaluate JIC plans and procedures and provide DOE staff with experience in working with offsite EROs. Drills also help train JIC personnel in the public information functions that must be performed in an emergency. At a minimum, both drills and exercises should be used to retrain, evaluate, and provide experience to personnel in the areas proved deficient during past drills, exercises, or actual events, or to implement new ideas and procedures.

This guidance also applies to developing scenarios whereby all persons with a response role in the EPI Program are sufficiently drilled. The EPI organization always should have a representative on the scenario development team for an exercise involving EPI to ensure the objectives of the EPI organization are incorporated and lessons learned are fed back into the JIC operation and EPI Program.

Every EPI team member should participate in at least one exercise annually. During an exercise, particular attention should be placed on the EPI team's performance; the effectiveness of information coordination, production, dissemination, monitoring and analysis functions; and the overall effectiveness of disseminating timely and accurate information to the public and media.

4.3 Media Relations

The news media is the major conduit through which the public perceives how DOE and contractors respond to an emergency. Within available resources, every effort should be made to accommodate the needs of the media. Cooperation should result in balanced, accurate information dissemination. Senior DOE management should be accessible, prompt, and forthright in dealing with the media prior to, during, and after emergency events. Credibility and empathy are imperative. Effective and prompt interface with the media and the public before, during, and after an event builds such credibility.

4.3.1 Guidelines

The following methods are suggested for use in emergency situations at DOE sites or involving DOE assets offsite.

- During an emergency, or as other events warrant, the EPI Organization and the JIC should be established as the single authoritative source of information regarding the event response, protective actions implemented onsite and recommended to offsite authorities, and long-term implications.

- If the health and safety of the public and/or site personnel are in jeopardy, this must be addressed immediately and candidly. Response to public perception also must be addressed immediately and candidly. "Perception is reality."

- Avoid use of technical jargon during news conferences. While it is important to have available technical details of an incident or accident, it is imperative that an explanation in lay terms be made as quickly as possible.

- Continuing education should be provided to the news media. The media should be invited and encouraged to participate in emergency response training, including drills and exercises, and to acquaint themselves with the facility management, emergency plans, and emergency points of contact. This education could be accomplished through special events at the site, editorial board visits, tours, or similar activities.

4.3.2 News Releases

Considerations for preparation, approval, and dissemination of news releases are as follows.

- A timely response to public/media is imperative to establish credibility. "Fill-in-the-blank," pre-format news releases should be prepared and approved in advance. An initial announcement may state: ***"There has been an X at X facility; details will be available at a news conference at X location. A Joint Information Center has been established and the media inquiry phone number is X. The public inquiry phone number is X."***

- The approval process should not be a hindrance. DOE Headquarters approval of initial news releases is not required in an emergency in order to provide health and safety information to the public. However, copies of news releases should be provided to DOE Headquarters as soon as practicable. Subsequent news releases should be coordinated with the Headquarters Public Affairs representative in the Headquarters EOC (EMT). Procedures for the approval protocol for news releases must be established. All individuals and alternates who are responsible for such approvals should be designated responders within the emergency organization.

- While DOE Orders stipulate that news releases and other associated notifications or news conferences occur in a "reasonable" time frame, DOE should adhere to the standards of other Federal agencies and private industry by releasing information within 1 hour of the event. Also, JIC organizations should be cognizant of the deadline schedules of all media (radio, television, and print) to maximize the timing of press releases.

- Chronological files of news releases, pending releases, media inquiries, and rumor control should be maintained for reference. Printed material supplied to the media should be numbered for easy reference.

- Photographs, maps, charts, and other visual aids should be prepared in advance. Materials should be easy to read and of print and broadcast quality.

4.3.3 News Conferences

News conferences should be held as emergency events or public and media interest warrant. However, there should be <u>a minimum of</u> two news conferences a day for the duration of the emergency. They should be scheduled with media deadlines in mind. News conferences should be announced in advance so maximum attendance, and therefore, maximum information dissemination, can be achieved.

Information provided at news conferences or in news releases should be coordinated with and monitored by each organization represented in the JIC to ensure consistency. This cooperation should include procedures for verbal and/or written acknowledgment of review of news releases and participation in meetings prior to news conferences to determine what is going to be addressed and who will speak.

4.4 Offsite Coordination

EPI plans should provide for cooperative interface and coordination of public education and information activities with local, state, tribal, and Federal response organizations.

4.4.1 Public Education

A program to educate the public is the foundation of an effective and accurate EPI Program. Up-front planning can ensure that the public understands the messages given during an emergency, which explain the risks posed to them and the protective actions they must take. The public education program therefore must be based on the actual risks posed by the site/facility/activity as defined by the Hazards Survey/Hazard Assessment process. The Local Emergency Planning Committee (LEPC) or local emergency management agency should be involved in communicating this information to the community and planning the offsite responses.

Education should include information on notifications and protective actions, both onsite and offsite. Information may be disseminated in lectures, radio programs, or written materials, such as calendars, brochures, telephone books, etc., to be used in residences, offices, hotels, and other public locations. Information should include shelter-in-place, evacuation routes, relocation centers, locator services, risks and hazards onsite, and appropriate radio frequencies and/or television/cable stations used for public information and Emergency Alert System announcements. A 24-hour general public information phone number for public inquiry should be publicized. A media kit should be available for all radio, TV stations, newspapers, and other periodicals.

Other items to be addressed include special needs such as transportation for the handicapped, hospital information, respiratory protection, and “radio-protective" drugs, where applicable. Issues concerning special facilities such as schools, prisons, nursing homes, senior citizen or child care facilities, shopping centers, and businesses within the EPZ should be addressed. Transportation is an important element of which the public should be aware (e.g., bus service, ambulances, and traffic control procedures used by local law enforcement). Agricultural information also is important. State and local representatives will need to provide educational material to farmers, market vendors, milk producers, and others dependent on land within the EPZ or potentially affected areas.

An annual media day is an excellent time to implement the public education program. The local media must be seen as part of the emergency management team. If the media is educated in the risks posed by the site/facility/activity, it can better fulfill the role of communicating effectively and accurately to the public. The media also must understand the elements of the site/facility/activity emergency information program. An open house, in conjunction with media day or the site annual exercise, is an excellent way to involve the media in public education and gain support from the community.

4.4.2 Offsite Response Organizations

EPI plans should provide for cooperative interface and coordination of public education and information activities with local, state, tribal, and Federal response organizations. There should be continual interface with local, State, Tribal, and Federal representatives, local executives, and the Governor's office to ensure accuracy of information during an emergency. These interfaces should be arranged and documented in formal plans, memoranda of agreement or understanding, and/or other arrangements. Local, state, and tribal governments should be encouraged to prepare their own public information response plans and implementing procedures in conjunction with the site/facility EPI planning effort. Local, state, and tribal governments should be encouraged to participate in EPI training and drills/exercises conducted by the site.

4.5 Bibliography

DOE 151.1 Chg 2. *Comprehensive Emergency Management System.* October 25, 1996.

Title 40 CFR 300. *National Oil and Hazardous Substances Pollution Contingency Plan.*

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5. EMERGENCY FACILITIES AND EQUIPMENT

5.1 Introduction

Most DOE facilities and sites have established emergency facilities and equipment to support response activities. The intent of this guide is to clarify requirements of the order to ensure that all such emergency facilities and equipment are considered by the emergency management program and that activities conducted at these emergency facilities are fully integrated. Purchases of new equipment, construction of new emergency facilities or designation of additional emergency facilities are not intended, if the current arrangement adequately supports the activities of the ERO.

DOE O 151.1 requires that emergency facilities and equipment be established and maintained for effective emergency response. The Operational Emergency Base Program requirements are driven by worker safety and environmental concerns and result from compliance with other DOE orders, Federal codes and regulations, and local and state regulations. These requirements mandate the ability of the site/facility to properly notify, implement protective actions for, and maintain accountability of, affected employees in the event of an emergency.

Facilities and equipment necessary to support the Operational Emergency Hazardous Material Program build upon those required for the Base Program. Additional requirements include a facility to serve as a command center, an alternate command center in the event the primary is not available, and adequate equipment and supplies to meet the needs determined by the results of the Hazards Assessment. Depending upon these results, additional emergency facilities may be necessary, such as technical support; security; personnel assembly/control; decontamination; medical services; process control; and chemical/radiological analytic laboratories.

For either the Base or Hazardous Materials Programs, equipment and facilities throughout each site, which may be under different administrative organizations, should be integrated to provide an overall, sitewide response capability.

This chapter describes how the Hazards Survey and Assessment processes are used to help determine facility and equipment needs. General design and siting considerations are provided for each type of response facility. Suggestions for equipment to support response functions are provided. The user is provided with qualitative guidance to help identify needs and to design and procure facilities and equipment.

Base Program. DOE O 151.1 requirements for the Operational Emergency Base Program are basically driven by worker safety and environmental concerns. These requirements mandate the ability of the site/facility to properly notify, take protective actions, and maintain accountability of affected employees in the event of an emergency. The results of the Hazards Survey are used to help determine if the minimum requirements of the Base Program are being met. Section 5.2 provides a discussion of this process. The guidance provided in the remainder of the chapter is aimed at the needs of the Hazardous Materials Program; however, the information may be useful in addressing the needs of a Base Program.

5.2 Role of Hazards Survey

The qualitative results of the facility/site-specific Hazards Survey serves as the key technical basis for identifying the types and levels of emergency facilities and equipment to support an emergency response. Results from the Hazards Survey should be used to verify that the following minimum emergency facility and equipment requirements are satisfied:

(1) **Notification/Communication Equipment**. The facility/site must have the ability to notify all affected onsite individuals of an emergency condition in a timely manner and direct them appropriately. This is usually conveyed by a public address system and/or alarm sirens, horn blasts, etc. Notification to emergency responders (e.g. fire, medical, police departments) are usually conducted on a radio/telephone, hard line/battery-type redundant system to reasonability assure communication at all times. This same system will also serve to notify other appropriate Federal, state, tribal, and local organizations, as well as additional DOE entities (as prescribed by DOE O 232.1). Many DOE facilities/sites have designated radio frequencies and dedicated telephone lines to be used only for emergency purposes. OSHA standards in 29 CFR 1910.165 are directly applicable. If offsite response forces will be integrated into the overall facility/site response, communications must be compatible. The facility/site may need to provide mobile, compatible links to these organizations or establish other means of communications, such as exchanging liaisons.

(2) **Protective Actions.** Depending on the type of emergency at a facility/site, the effective sheltering or transporting of onsite personnel for evacuation purposes may be desirable or necessary. Pre-designating the locations of these potential shelters and rally points for evacuation are critical in order to support onsite direction and coordination actions (e.g. temporary billeting, transportation) and obtaining accurate accountability of personnel. Understanding the peak, onsite number of personnel which could potentially be affected by the emergency (as developed by the Hazards Survey) will help determine the size/type of sheltering facility, numbers/types of vehicles needed to support their evacuation, and optimum personnel accountability system.

(3) **Accountability Processing**. The capability to accurately determine the whereabouts and current status of onsite personnel during an emergency requires that the facility/site maintain a personnel accountability system. The complexity of the system could be no more than a "roll call," if it serves to accurately determine accountability after evacuation. Whatever is to be used, from simple "roll calls" to fully automated badge-reader systems, considerations must be given to optimum placement, utility needs, and mobility requirements.

A Base Program site/facility, especially a minimal program, will probably not need to take advantage of the guidance contained in the remainder of this chapter.

5.3 Role of Hazards Assessment

Hazards Assessment results used to identify the emergency facility and equipment needs include the following.

- Hazardous material(s) forms, quantities, and locations.
- Release modes.
- Concentrations, magnitude, and severity at various receptor points.
- Emergency class(es) corresponding to analyzed events.
- Time to consequence.
- Persistence of released material in the environment.
- Effective and appropriate protective actions.
- EPZs.
- Demographics of potentially affected areas.
- Onsite and offsite organizations potentially affected by the material(s) released.
- Impact of hazardous material releases on positions requiring occupancy for safe operation, security, or monitoring.

Specific results from the Hazards Assessment and how they may influence the emergency facility and equipment needs include the following.

- **Estimated duration of hazardous material releases.** This output of the Hazards Assessment can be used to determine facilities and equipment features such as sophisticated prompt notification systems; EOC HVAC system filtration capability; the equipment to be staged for field monitoring teams; and plans for extended occupancy of emergency facilities.

- **Potential for successful mitigative actions.** This output can be used to determine the facilities and equipment features such as facilities, equipment, and staffing plans for mitigation oriented functions, such as technical support and operations support; coordination of onsite and offsite firefighting assets; and the degree to which emergency facilities are equipped with analytical tools (e.g., drawings, computers, and work-space for problem-solving teams).

- **Measurement or consequence assessment methods that are applicable for the material and release types.** This output can be used to determine facilities and equipment features, such as use of manual-versus-computerized consequence assessment methods; adequacy of installed monitoring and detection instrumentation; specific field team instruments; and the level of sophistication of meteorological instruments and ability to access forecast information.

- **Events and hazardous materials involving security considerations.** This output can be used to determine facilities and equipment features, such as secure communications between emergency facilities; processing, storing, and discussing classified information within emergency facilities, thus establishing the level of physical security to be provided at emergency facilities; respiratory protection equipment for security personnel; and hazardous materials monitoring equipment for security personnel and vehicles.

The Hazards Assessment results can be used to help identify potential locations and habitability requirements for emergency facilities. Consequence estimates derived from the Hazards Assessment will identify areas potentially affected by hazardous materials releases. The need for a determination of habitability or an alternate EOC/command center can be eliminated if a primary EOC/command center can be located outside any potentially affected area. Habitability requirements for an EOC/command center located within a potentially affected area should be determined by the consequence estimates. An existing structure may have the necessary features to maintain habitability. The consequence estimates can also be used to determine a suitable location for the alternate. Staging facilities/areas could also be identified for such diverse emergency needs as personnel evacuation and accountability, decontamination sites, and casualty management locations through this process.

Comparison of emergency facility and equipment needs identified through the results of the Hazards Assessment with existing facilities and equipment can help eliminate duplication and redundancy. Selected equipment, such as radiation or hazardous material detection instruments, self-contained breathing apparatus, and emergency repair materials, as necessary, may need to be dedicated for emergency use only. However, whenever possible, existing facilities and equipment should be used to meet these needs.

The need for and the types of additional facilities and equipment should be determined on the basis of lessening the onsite and offsite consequences of an incident or accident. Establishing sophisticated facilities and equipment (e.g., technical support center and operations support center) to support mitigation activities may not be appropriate, for example, if the likely duration of hazardous material releases is shorter than the time needed to activate emergency response resources. Mitigation-oriented facilities may not be necessary if most of the more severe analyzed accidents are massive puff releases. However, if some portion of the severe accidents involve prolonged releases, complex process systems, or conditions that deteriorate over time (e.g., a fire spreading throughout a facility containing multiple hazard sources), then mitigation-oriented facilities and equipment may be warranted.

Examples of enhanced mitigation activities include enhanced firefighting capability; ability to modify or create impromptu operations and maintenance procedures; staging areas for tools and personnel; and command and control infrastructures necessary to carry out mitigation activities.

A thorough assessment of the potential magnitude of consequences will help the emergency planner develop logistical contingencies to support all response activities through emergency termination and recovery. These include adequate housing, vehicles, food services, and general services and consumables (e.g., office supplies and equipment, construction materials, and minor repairs to computer equipment).

5.4 Emergency Response Facilities

5.4.1 Emergency Operations Center (EOC)

The EOC is the primary emergency facility for allowing the Emergency Management Team (EMT) component of the ERO to fulfill its emergency response functions and responsibilities. Its design and operations should provide for effective emergency response based on an analysis of emergency response needs, with consideration given to human interface requirements.

To be considered habitable, the EOC should remain operational and life-supporting for an extended period of time under accident conditions (as derived from the facility Hazards Assessment) and maintain its structural integrity under various design basis events, including natural phenomena. A habitable EOC should satisfy the following criteria.

- **Breathable atmosphere.** The HVAC system should be designed to maintain safe oxygen levels, provide for air contaminant removal and filtration to prevent intake of contaminated outside air, and establish a positive pressure to prevent the infiltration of contaminated air. Equipment should be available to confirm that the atmosphere remains uncontaminated.

- **Shielding.** Sufficient shielding from radioactive materials should be provided to permit continued occupancy of the EOC for its maximum expected activation time without exceeding recommended exposure levels.

- **Back-up emergency power.** A loss of normal electrical power should not preclude the EOC from performing its functions.

The design of the EOC should follow human-factor principles for comfort, noise reduction, lighting, and work-group interfaces. Controlled access should maintain security, accountability, and order within the EOC. Sufficient space and equipment should be provided to permit the EMT to effectively and efficiently perform its functions, especially command and control. The facilities should promote the active support of on-scene responders, versus simply providing an incident-tracking capability.

A resource area with current, electronic, and hard-copy reference materials, such as operating procedures, technical safety requirements, emergency plans and procedures, safety analyses, offsite demographic data, evacuation plans, and environmental monitoring records, should be designated and maintained to allow for ready accessibility and use by the EMT.

If the EOC is a dual-use facility, then plans and procedures should be in place and tested to ensure the facility can be rapidly converted into an EOC.

5.4.2 Alternate EOC

An alternate EOC must be available if the primary EOC becomes uninhabitable. The alternate does not have to duplicate every design feature and equipment of the primary as long as it allows the EMT to perform necessary functions in an effective manner. The following points should be considered in the design and operation of an alternate.

The alternate EOC should be located where the likelihood of both the primary EOC and the alternate being rendered uninhabitable by the same event is minimized. Consideration should be given to placing the alternate outside the EPZ or 180 degrees opposite (i.e., upwind from the prevailing wind direction) the EOC. Monitoring equipment should be available to confirm the habitability of the alternate. Accessibility and ability to provide controlled access and secure communications should be considered in selecting the alternate location.

Communications and information processing systems for the alternate EOC should meet the same capability specifications as for the primary. Back-up communications, such as cellular phones, should be made available to maintain command and control.

Reference material, including plans, procedures, and maps, should be available in the alternate EOC or provisions made to obtain them from other emergency facilities as needed.

Transfer and activation procedures should be prepared for shifting responsibilities from the primary EOC to the alternate during an emergency.

5.4.3 Command Center

All aspects of an EOC, as discussed above, are directly relevant to a command center. However, the mandatory, prescriptive requirements of an EOC are not applicable. At a minimum, a command center must ensure it has the capability to effectively integrate all of the following five functional elements.

- Command, which also includes safety, public information, and liaison.
- Operations.
- Planning.
- Logistics.
- Finance.

This configuration meets the intent of OSHA requirements in 29 CFR 1910.120(q) and describes the basic functional make-up of an Incident Command System. However, depending upon the actual emergency, these elements and their sub-elements should be tailored to needs dictated by the event, not by an automatic, one-size-fits-all configuration. A command center must, therefore, be able to flexibly support management of the site/facility response while coordinating and meeting its Federal, state, tribal, and local obligations.

5.4.4 Joint Information Center (JIC)

The Order requires that a designated facility exist to "provide support in media services, public inquiry, media inquiry, JIC management and administrative activities, and media monitoring." The JIC should be located to facilitate access by the media and public. A collocated JIC, with local, state, tribal, and other Federal officials, is encouraged to present a coordinated response to the public. Volume IV, Chapter 4 details further considerations for JIC facilities and equipment requirements.

5.4.5 Other Emergency Facilities

In addition to the primary EOC, alternate EOC, command center, and the JIC, a variety of other emergency facilities may be necessary to accommodate the response activities as determined by the facility Hazards Survey/Assessment. Variations in the physical arrangement of other augmenting emergency facilities depend on the size, nature, and organization of the facility/site ERO. These aspects may include the following.

- A **manned operations area**, such as the control room or process control station from which facility operations are controlled or monitored. This is where an emergency would most likely be detected and reported and initial mitigative actions implemented.

- A **technical support center** from which detailed technical support and assistance is provided to the ERO. This is where activities such as technical assessments and engineering support are coordinated.

- An **operations support center** from which activities involving maintenance, health physics, industrial hygiene, and operations resource personnel are coordinated and directed. This is typically the dispatching point for field monitoring teams, search and rescue teams, damage control and equipment repair teams, and emergency equipment operators.

Other facilities used on a routine basis to support facility/site response activities during an Operational Emergency could be considered emergency facilities. Examples include security patrol headquarters, notification centers, medical stations, decontamination stations, assembly points, and central alarm stations.

An analysis of the functional requirements of the ERO, integrating results from the Hazards Survey/Assessment, may result in combining similar functions in an emergency facility. Examples of potential emergency facility arrangements include the following.

- Combining all emergency response control and coordination functions in an EOC/command center, with separate specialty functions in rooms or partitioned areas.

- Combining the technical support center and EOC/command center.

- Combining the technical support center and operations support center.

- Establishing individual facility technical support centers and operational support centers, along with a common EOC/command center for the entire site.

- Dividing operations support center functions among multiple emergency facilities (e.g., repair, monitoring, and operations staff staged in separate locations).

5.5 Emergency Response Equipment

5.5.1 Command, Control, and Communications Equipment

Command, control, and communications are the most important functions of the ERO. Primary, as well as back-up, equipment and alternative processes (to include redundant manual systems) must be considered to ensure a continually functioning set of command, control, and communication capabilities.

Decision aids and information displays to support the command and control functions of the ERO should be provided. Equipment to be considered includes the following.

- Status boards should provide a synopsis of the emergency. Key information should be presented on the status boards, including facility and system parameters; effluent releases; environmental monitoring and measurements; consequence assessments; protective actions; notifications; accountability; and search and rescue. Status boards offer information to the ERO at a glance, confirming reports that response actions have been made and that future actions have been identified.

- Data from installed instrumentation (e.g., meteorological and source term) critical to command and control (i.e., protective actions, classification, etc.,) should be available to appropriate ERO personnel.

Primary and back-up communications systems should be provided to ensure effective communications critical to command and control of emergency response activities. Further guidance on communication and information processing systems is contained in the *Final Report of the Department of Energy Task Force on Compatibility of Emergency Operations Center Communications and Information Processing Systems.*

- While the Compatibility Study provides guidance on the communications links necessary to pass information to DOE elements, consideration must also be given to compatible communications systems to pass notification reports to other Federal, state, tribal, and local government agencies. Standard procedures and forms should be developed to ensure that information can be passed quickly and accurately during an emergency.

- Secure communications equipment is necessary for transmitting classified information.

- Additional guidance impacting the design of communications systems used for notifications reports can be found in Volume III, Chapter 4 and Volume III, Chapter 2.

- Primary and back-up communication links for mobile personnel, such as field teams and incident commanders, should be provided, tested, and maintained. If offsite response forces will be integrated into the overall facility/site response, communications must be compatible. The facility/site may be required to provide mobile, compatible communications links to these offsite organizations.

- Communications networks used to support daily operations at a facility/site should be compatible with the networks established to exercise command and control of emergency response. For example, fire departments and brigades, security patrols, and craft departments often have established radio networks to communicate with central dispatch facilities. Equipment within the EOC/command center may be needed to ensure that direction provided by the Emergency Director or "Incident Commander" is accurately and quickly transmitted to all emergency response elements.

5.5.2 Consequence Assessment Equipment

The level of sophistication required for consequence assessment capabilities, such as meteorological data acquisition, calculational model complexity, accident range instrumentation, data entry, and field monitoring capabilities, should be determined based on the results of the Hazards Survey/Assessment. Volume IV, Chapter 1 provides recommended methods based on maximum event classification at the facility.

Adequate equipment should be staged and readily available to provide hazard characterizations to site personnel and the public and to permit prompt protective action response. Installed monitoring systems needed for accident characterization should have back-up power to ensure continued operability in an accident.

Field monitoring equipment should be capable of measuring data on concentrations/ exposures of interest during emergency response. If plans include the deployment of joint DOE/state/local monitoring teams, then standardized or compatible monitoring and communication equipment should be used. Instruments suitable for determining occupational exposures during normal operations may not be capable of recording accident event concentrations. (Regardless of the choice of instrument types, consequence assessment data/results should be compatible in terms of engineering units, conversion factors, and the severity thresholds.)

5.5.3 Protective Action Equipment

Hazards Assessment results concerning affected areas and the nature of hazards, the types of possible effects, the time to those effects, and the population affected are useful for determining requirements for equipment, materials, and facilities needed for protective action implementation. Detailed guidance is provided in Volume IV, Chapter 2.

Respiratory protection and protective clothing may be necessary to protect workers in a contaminated environment, to allow escape, and to protect emergency workers during re-entry to a contaminated facility. The type of respiratory protection and protective clothing should be based on the Hazards Assessment and consequence determination. The possibility of inhalation and absorption through the skin should be considered in determining the type and quantity of protective clothing. Additional discussion of requirements for personnel protective equipment can be found in Hazardous Waste Operations and Emergency Responses (HAZWOPER) standards; Appendix B, 29 CFR 1910.120; 29 CFR 1910.132 through 1910.140; and NFPA Standards 1991, 1992, 1993 and 1999. Additional guidance is contained in Volume X.

Specific locations within the facility, such as security posts or operations control rooms, are critical and may have to be continuously manned. The Hazards Assessment should be used to determine requirements for protective equipment that should be available at these locations.

Consideration should be given to standardization of equipment needed for implementing protective actions across a facility/site. This would enable routine operating stocks maintained by organizations, such as the fire department and the hazardous materials response group, to be pooled with any dedicated emergency equipment inventory. Standard equipment allows for ease of maintenance and greater flexibility during response.

Transportation equipment should be provided, or identified as readily available, such as by means of a Memorandum of Agreement (MOA), for use in evacuating nonessential personnel within the onsite EPZ to a safe location following an evacuation order. The determination of suitable modes of transportation should consider disabled workers. Transportation equipment could include automobiles, buses, vans, ambulances, and cargo vehicles. This equipment can either be owned and maintained by the site or facility, or may be available from state, local, or private organizations via a contract or MOAs.

5.5.4 Medical Equipment

Sufficient medical equipment should be available to treat both workers and responders who may be injured during an emergency. Emergency planners should coordinate closely with medical professionals to ensure that appropriate treatment is available for analyzed accident scenarios, the types and nature of injuries that must be treated, the kinds of contamination that can be expected, the number of personnel that could become casualties, and the time-frames during which treatment must be provided to be effective. The types and amounts of medical equipment needed to respond to a mass casualty event should be evaluated and planned for.

DOE O 440.1 and its supporting guidance document provides further information on requirements for onsite and offsite medical equipment requirements. In addition, Volume IV, Chapter 3 should be consulted.

5.5.5 Public Information Equipment

Audio-visual and data processing equipment dedicated to communications with the media and the public should be available. While some equipment may be dedicated to public information activities as part of normal operations, assets may need to be upgraded to accommodate the vastly greater demands for public information dissemination that will be generated in an emergency situation. While members of the media will have some equipment needed to execute assignments, a greater demand for onsite support interfaces (e.g., phone lines, power supplies, etc.,) should be anticipated. Detailed guidance in this area is provided in Volume IV, Chapter 4.

5.5.6 Additional Support Equipment

Access control equipment for the EOC and any other emergency facility is essential to ensure that the ERO functions without interruption or disruption. Access control equipment may be necessary to ensure that access to temporarily sensitive security areas or potentially contaminated areas is restricted. If an atmospheric release may affect areas beyond facility boundaries, coordination should occur with offsite authorities regarding the equipment necessary to extend a perimeter beyond the traditional facility and/or site boundary for access control purposes. The security force is usually tasked to carry out access control activities.

Fire departments or brigades normally make up a substantial portion of the emergency response force at a facility/site. DOE O 420.1 requires that a “Baseline Needs Assessment” establish the minimum required capabilities of fire fighting forces. Once determined, these capabilities are required to be reflected in the emergency plan. Emergency planners should coordinate with counterparts in the fire protection organization to ensure that all hazards noted in the Hazard Survey and Hazards Assessment are incorporated, as appropriate, into the “Baseline Needs Assessment.” DOE G 420.1/B-0/440.1/E-0, the implementation guide for fire safety requirements in DOE O 420.1 and DOE O 440.1, provides assistance in conducting the “Baseline Needs Assessment.”

Spill containment equipment and supplies should be available for immediate use following declaration of an emergency, if necessary, based on the Hazards Survey/Assessment. This includes containment equipment (e.g., booms and berm-making equipment) to minimize the environmental impacts of runoff (such as from a tank failure or firefighting efforts). Other equipment needs might include heavy construction equipment, portable power supplies, temporary sanitation equipment, specialized tools, and replacement parts. Additional supplies that might be required include personnel protective equipment, dosimeters, medical supplies, office supplies, fire fighting expendables, and construction supplies. As with fire, medical, and hazardous material equipment, consideration should be given to arranging these resources with offsite organizations. The availability of such offsite resources, including the names of equipment operators, should be documented in MOAs.

Emergency response personnel should have at their disposal the necessary equipment for reentry and recovery activities. Although maintaining an onsite inventory of <u>all</u> equipment possibly required for reentry and recovery efforts is not practical, a resource list for short-notice procurement should be available. Additional guidance is provided in Volume IV, Chapter 2 and Volume IV, Chapter 6.

Logistic support can be arranged through elements of the ERO or from other Federal, state, tribal, local, or private sources. Commitments to have these resources available immediately as needed can be ensured through MOAs. Examples of facilities and services that could be needed include hazardous materials response, bomb removal, hostage negotiations, medical/morgue services, critical incident tress teams, analytical laboratory services, aerial survey support, personnel transportation, food services, contaminated laundry service, and dosimetry support. Planners should consider the potential impact of resources from offsite organizations not being available in the event of a disaster that affects a large area. Additional information on establishing interfaces with offsite response groups is provided in Volume III, Chapter 2.

Administrative support such as document and clerical services may be required during emergencies.

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6. TERMINATION AND RECOVERY

6.1 Introduction

Termination and recovery are two separate but related activities, each with its own purpose and implementation concerns. For purposes of this guide event **Termination** is the conclusion of an Operational Emergency and includes a determination of when it is appropriate to cease emergency response activities and of associated notifications.

The termination process begins when personnel in charge of the response effort determine that conditions are sufficiently stabilized to begin comparing them to pre-established decisional criteria. The termination decision and subsequent notification that an event no longer constitutes an Operational Emergency marks the beginning of recovery.

Recovery is defined as those actions taken, after a facility has been brought to a stable or shutdown condition, to return the facility to normal operation. For purposes of this guide, the recovery period will begin when the emergency response to an Operational Emergency is declared terminated. The recovery phase continues until the facility and any affected areas meet predetermined criteria for the resumption of normal operation or use.

The types of activities that could be conducted during the recovery phase include (but are not limited to): damage assessment, environmental consequence assessment, long-term protective action determinations, facility and/or environmental restoration, and dissemination of information. Some activities required to implement recovery are similar to those performed during reentry in that they may involve entering a facility or affected area in which hazardous materials have been released (Also see Volume IV, Chapter 2.)

The results of the facility-specific Hazards Surveys and Assessments are used to help establish the basic criteria and organizational structure necessary for conducting termination and recovery activities. Emergency response plans provide for creation of specific procedures, criteria, and other aids to identify the point at which emergency response activities can be terminated and to implement the concept of operations for recovery in a timely and efficient fashion. Planning and implementation of termination and recovery should be coordinated with the needs and requirements of the state and local EROs. The emergency plan should explicitly give the ERO the responsibility and the authority to terminate emergency response activities and to implement the transition from emergency response to recovery.

Base Program. The Order requires that, at a minimum, recovery shall include notifications associated with termination of an emergency and establishment of criteria for resumption of normal operations. Although the guidance given in this chapter is focused on Hazardous Materials Programs, the general concepts of termination and recovery presented can be applied to the Operational Emergencies identified by the site/facility-specific Hazards Survey for the Base Program.

6.2 Termination

The decision to terminate emergency response should be made with the concurrence of all principle participating response organizations. General criteria should be developed that, when met, will allow emergency managers to declare the emergency response phase terminated and initiate accident recovery. The following are selected examples (not all-inclusive) of event termination criteria.

- The facility/site and DOE management, in consultation with appropriate offsite agencies, do not identify a valid reason to continue operating in the emergency response mode.
- Radiation or hazardous material exposure levels within the affected facility or area(s) are stable or decreasing with time.
- The affected facility or site is in a stable condition, and there is a high probability that it can be maintained in that condition.
- Fire, flood, earthquake, or similar emergency conditions no longer constitute a hazard to critical systems/equipment or to personnel.
- Releases of hazardous material to the environment have ceased or are controlled within permissible regulatory limits, and the potential for an uncontrolled release is low.
- Existing conditions no longer meet the established emergency categorization or classification criteria, and it appears unlikely that conditions will deteriorate.
- No surveillance relative to protective actions is needed, except for ingestion pathway concerns and contamination and/or environmental assessment activities.
- The needs of all contaminated/injured personnel have been fulfilled.
- All initial emergency notifications have been completed.
- Access to affected areas necessary for conducting recovery operations has been assessed.

- The incident scene can be preserved until cognizant investigative authority concurs that recovery operations may begin.
- Initial recovery activities have been clearly identified and prioritized.
- The recovery staffing plan has been developed, approved, and can be implemented.

6.3 Recovery

The objective of the recovery effort is to return the affected facilities and areas to normal operations following the termination of emergency response. Implementation and the level of effort required will be determined by the nature and magnitude of the emergency event. The planning and procedural elements will need to address a wide range of possible circumstances and as a result will be general in nature. Recovery functions that need to be established in plans and procedures include creation of a recovery organization and conduct of recovery operations.

6.3.1 Recovery Organization

Prior to terminating an emergency response, the ERO should establish the recovery organization and determine the resources needed to begin recovery operations.

The recovery organization is responsible for coordinating all recovery activities. Responsibilities include, but are not limited to: prioritization of activities; protection of worker and general public health and safety; dissemination of information; coordination of site and offsite activities; collection of data and assessment of long-term effects associated with the release of hazardous materials; formulation and implementation of long-term protective actions for the affected areas; and providing assistance as requested to state and local agencies in formulation of long-term protective actions for affected offsite areas.

If negative effects to facilities and/or the environment are minimal, the normal operations and maintenance organizations may be able to perform all necessary recovery actions. At a minimum, a Recovery Manager should be appointed to coordinate planning and authorize recovery operations.

When a dedicated recovery organization is necessary, it should parallel the normal facility or site operating organization, when possible.

To the extent possible, recovery activities should be carried out through normal facility and site operations. This arrangement provides the recovery management and staff with established and recognized channels of communication, authority, and control to facilitate the accomplishment of their mission.

The composition of the recovery organization should be based on the extent and nature of the emergency. Functional elements in a recovery organization should include the following.

- A Recovery Manager who has the responsibility and authority to coordinate recovery planning; authorize recovery activities; protect the health and safety of workers and the public; and initiate, change, or recommend protective actions. This position should have management authority commensurate with the requirements of the recovery activities.

- Technical advisers to the Recovery Manager, which may include health physics, industrial hygiene, industrial safety, fire protection, and other experts.

- Personnel with the technical expertise to direct post-accident assessment activities and to analyze the results. Maintenance and operations personnel and engineers normally staff these positions.

- A Public Information Specialist to deal with inquiries or concerns from employees, the public, the news media, and outside agencies. A Public Information Specialist may expect to address accident investigation results, the extent of onsite and offsite impacts, and the status of recovery operations.

6.3.2 Recovery Operations

Recovery planning and implementation will start with assessment of facility, site, and environmental conditions. Some recovery activities may be conducted under conditions similar to those of the reentry activities. Therefore, the reentry considerations discussed in Volume IV, Chapter 2 may be applicable to recovery operations. There are three general areas of recovery operations: accident assessment and investigation, recovery planning and scheduling, and repair and restoration.

Accident assessment and investigation. The following types of activities should be considered for accident assessment and investigation.

- The facility/site management, in coordinating with DOE management, should establish an Investigation Board to determine the root cause of the event and prepare a formal accident report.

- All documentation generated during the emergency response and useful to accident investigation should be collected and organized.

- Engineering/Maintenance/Operations personnel should assess the condition of the facility including structural integrity, equipment status, hazardous material containment/confinement barriers, and safety systems.

- A comprehensive assessment of contamination of all affected areas should be performed. As soon as sufficient information is available, consideration should be given to modification or termination of facility/site protective actions instituted during emergency response. Monitoring and laboratory analysis results should be used as the bases for determining long-term (e.g., ingestion pathway) protective actions for affected areas. (More information on long-term protective actions is contained in the EPA's Protective Action Manual.) Information should be provided to local and state governments concerning recommendations for long-term protective actions and the modification or termination of existing protective actions.

Recovery planning and scheduling. The following types of activities should be planned and scheduled.

- Notification to persons and agencies involved in the emergency response of the establishment of the Recovery Organization and the name of the person in charge.

- Evaluation of Emergency Plans to determine if adequate emergency preparedness status can be maintained during degraded facility conditions (i.e., inaccessibility of assembly areas, inoperative emergency/safety instrumentation and equipment, etc.).

- Establishment of specific criteria to be met prior to the resumption of normal operations or facility use. (See also Section 6.4.)

- Preparation of plans for the establishment of safe long-term conditions when the assessment indicates that a facility or affected area cannot be safely returned to normal operation or use.

- Identification of required repair and restoration work based on the assessment results.

- Plan for the proper handling and disposal of all hazardous waste generated during recovery activities.

- Establishment of a Tracking Group to monitor all assigned tasks, including developing work packages, scheduling activities, and estimating costs.

- Formation of a Procedures Review Group to determine if specialized procedures are required and should be developed and to review and approve all special procedures.

- Continued evaluation of site or facility hazards and contamination levels as well as estimating exposures to workers.

Repair and restoration activities. The following items should be considered during repair and restoration activities.

- Ensure that occupational exposure limits are followed as indicated in 10 CFR 835.202 or 10 CFR 835.204.

- Ensure that any discharges from recovery activity are controlled within regulatory and environmental compliance limits. If discharges are necessary beyond these limits, ensure that all necessary documentation is prepared, approvals obtained, and notifications made.

- Conduct recovery activities through normal work organizations, practices, limitations, and procedures to the extent practical.

- Replenish, repair, or replace any emergency equipment or consumable materials used during emergency response.

- Train applicable personnel on changes that occurred as a result of repair, restoration, and accident investigation.

6.4 Resumption of Normal Operations

Affected facilities and areas should be returned to normal operations or use only when all criteria established by the recovery organization have been met and all approvals granted by cognizant organizations and agencies. At a minimum, compliance should be required with Technical Specifications, Technical Safety Requirements, health and safety regulations, and environmental regulations. Federal, state, and local organizations should be consulted prior to terminating recovery operations, if required by regulation or MOU. Otherwise, notifications to these organizations should be made prior to the resumption of normal operations. As required, all documentation of recovery operations should be collected and processed for permanent storage.

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